FLIGHT

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Oct. 4	.. **Surrey Ae.C. Meeting, Gatwick Aerodrome.**
Oct. 9	.. **Lecture, "The Growth of Aviation," by C. R. Fairey, before R.Ae.S.**
Oct. 21	.. **Society of Engineers' Dinner to Miss Amy Johnson, at Holborn Restaurant.**
Oct. 23	.. **Lecture, "Air Transport in Fog," by F. W. Meredith, before R.Ae.S.**
Nov. 13	.. **Lecture, "Testing the Control of Aeroplanes," by H. L. Stevens, before R.Ae.S.**
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1932	
May 31	.. **Closing date for Cellon Cross-Channel Glide £1,000 Prize.**

EDITORIAL COMMENT

Special Mail Services

SIR SAMUEL HOARE made a very thoughtful, as well as a very interesting, address to the students of the Bonar Law College the other day. One point which he made seems to us to be particularly worthy to be read, marked, learnt, and inwardly digested. He started by describing the aeroplanes employed on British airways as "slow omnibus machines." We have often heard an aeroplane called by pilots "an old bus," but Sir Samuel Hoare has now given a new significance and a classical sanction to this expression. What he meant, of course, was that the types of machines used accept any, or almost any, freight, living or dead, which may be offered. No separate provision is made for the requirements of passengers and of mails. As, on the journey to India, the "pace is comparatively slow, the stops on the ground comparatively long, there is at present no night flying, and the journey takes a week," Sir Samuel pointed out that the service is much more suited to the needs of the passengers than to those of the mails. Even in this age of speed there is a limit to what the human traveller can stand. Most travellers still prefer a fortnight in a P. & O. steamer to a week in an aeroplane, even though the aeroplane lands for meals and for the night. It may well be, in like manner, in the future most passengers will prefer travelling in a 70 or even 60 m.p.h. airship to remaining day and night (or even only all day) in a 100 or 90 m.p.h. aeroplane. It is technically impossible to provide ample comfort in an aeroplane without an extravagant loss of pay-load per horsepower. Even to provide such safety and insurance against forced landings as is represented by the aeroplane which actually has one superfluous engine, has been a difficult concession to secure from designers and operating firms. The tendency to look for the maximum pay-load and chance the forced landings has died hard.

Mails are quite a different matter. For mail

traffic there are two requirements. Taking protection of the mail bags against fire and water, etc., as a *sine qua non*, it may be laid down that mails need (*a*) to arrive punctually, and (*b*) to travel as fast as is possible. They make no demands for comfort, for meals, or for sleep. Punctuality is their first requirement, and speed is their second. It took some time for aeronautical enthusiasts to grasp the great stress which every Post Office must lay upon punctuality. We can remember discussions in which the flying enthusiasts said in effect " We can guarantee a speed of 100 m.p.h. and an efficiency of 99 per cent., yet our benighted post office will have nothing to do with us." They forgot that a programme of three to four flights a day between Croydon and the Continent was not an extravagant effort of imagination, which would mean about 100 flights and one forced landing or other delay per month, or 12 delays in the year. Of course, no Post Office would consider such a prospect. Regularity at 50 m.p.h. is far more desirable than 99 per cent. efficiency at 100 m.p.h.

But, once regularity is assured, the next desideratum is for mails to travel at the greatest possible speed. One hundred miles an hour is far too slow, if 150 m.p.h. is a possibility. Sir Samuel Hoare cited a machine now used by the R.A.F. which, he said, can fly at 180 m.p.h., and he saw no reason why types of this kind should not be used for a mail service. It is a point which we have urged more than once ourselves. If the Hawker Hart can do something like 180 m.p.h. at great altitude with military equipment, a machine specially designed for carrying nothing but mails ought to be able to average not less than 150 m.p.h. without sacrificing that reliability which is the first essential

In an instalment of a series of articles on the air mail aeroplane which appears in THE AIRCRAFT ENGINEER Technical Supplement to FLIGHT this week Mr. Radcliffe goes into the subject fairly fully, and although his final conclusions and his promised sketch design for an " imaginary " mailplane is not included, he examines a number of machines for suitability, among them the Hawker " Hart." Whether the multi-engined machine with 33 per cent. power reserve, or the single-engined machine with, say, 50 per cent. reserve and better aerodynamic efficiency, will offer the best solution is at least open to debate. Mr. Radcliffe has not yet committed himself on that point, but his articles should be read with considerable interest.

A mail aeroplane resembles a military machine in this, that economic qualities hardly count, while performance is everything. A high ceiling it need not have, but its speed must grow ever greater and greater as technical progress makes it possible. One cannot convey mails too fast.

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R.A.F. Aeroplanes

The *Daily Telegraph* and the *Sunday Times* have admitted to a feeling of " disturbance " over an article in the former journal by that very able aeronautical journalist, Maj. C. C. Turner, in which he stressed the undisputed fact that " with the exception of two or three squadrons, the Royal Air Force is using types which are no longer up to date." The *Daily Telegraph* tried to make a bad case worse by adding the remark, " The use of old machines gives no sensible result in economy, owing to the constant need for repairs," a remark for which Maj. Turner was not responsible, and which shows that the sub-editorial staff of the paper does not clearly distinguish between an old aeroplane and an old type of machine.

What is rather surprising and astonishing is that the papers mentioned above should have regarded this article as " remarkable disclosures." A monthly " Air Force List " costs 1*s*. 6*d*., and in that useful little periodical may be read the type of machine with which each squadron is equipped. There is nothing secret about the matter ; but only a limited number of people take the trouble to inform themselves as to how long the " Siskin " and the " Gamecock " have been in service. We have ourselves adverted to this subject on occasions. In our issue of August 22 our special correspondent on the Air Exercises wrote : " The ' Siskin ' is admittedly obsolescent, and it would be flogging a dead horse to say much about the futility of sending up ' Siskins ' off the ground to catch ' Harts ' or ' Foxes.' We have now two squadrons equipped with ' Bulldogs,' and one now in process of receiving them. We should like to see the out-turn of ' Bulldogs ' very much expedited, and we look forward to the appearance, as soon as possible, of a squadron of interceptor fighters equipped with the ' Hornet.' We also hope that the complete equipment of our day-bomber squadrons with the ' Hart ' will proceed with due celerity."

The fact is that the Cabinet considers the political situation to be such that there is no need to hurry in bringing the Royal Air Force up to a state of efficiency (in the matter of equipment) such as would be necessary if war were considered even remotely probable. This, taken with the need for national economy, is the excuse for proceeding in a very leisurely manner in providing the squadrons of the command Air Defences of Great Britain with aircraft of the most up-to-date type. No other excuse could be accepted, but it cannot be denied that this plea has some force. At the same time, it must not be pushed too far, or we may unexpectedly find ourselves threatened before our A.D.G.B. is in a position to make air raids on this country a very expensive and sanguinary affair for the raiders. The greater part of the money voted in the last Air Estimates was earmarked for re-equipping the existing units of the Royal Air Force, in preference to raising new units—which is another step that would be vitally urgent if there were any prospect of our having to defend ourselves. We should like to see some result from those Estimates. We repeat that we want to see " Bulldogs " and " Hornets " the only machines in use by the Fighting Area, and " Harts " replace the obsolete types of day-bombers in the Wessex Bombing Area. We may add that it is now a long time since a new type of night-bomber was put on production. Though we do not agree that the types in use call for constant repairs, still, air manœuvres cannot teach their full lessons until our types of aeroplanes are all reasonably modern.

VICKERS "VIASTRA I"

Three Armstrong Siddeley Geared "Lynx" Engines

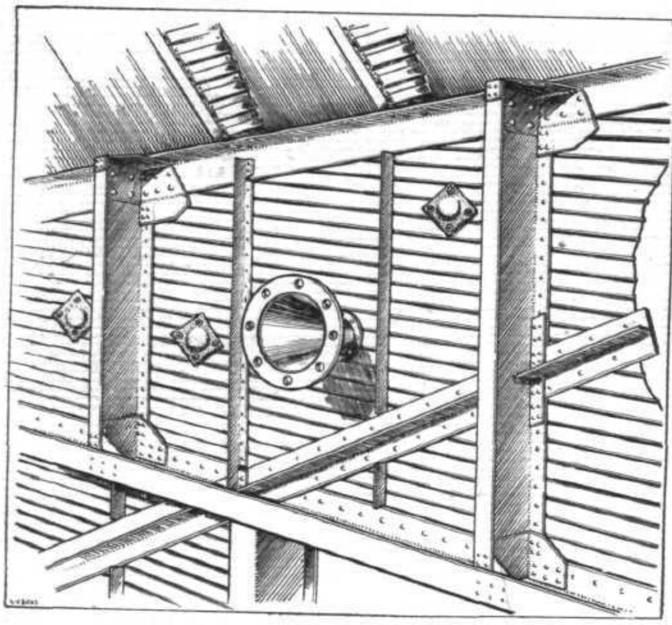
FOR several years it has been universally accepted that in order to secure immunity from forced landings the power plant of an aircraft should be divided into at least three individual units. Mathematicians have proved, at least to their own satisfaction, that with such an engine arrangement and a certain power reserve enabling the machine to fly on any two engines, forced landings should not occur. There is, however, a tendency nowadays rather to doubt the validity of this argument, and to advance as a counter to it that when one engine of a three-engined machine fails, the other two have to be run so nearly full out that they, in turn, are liable to break down. And it is sometimes pointed out that with the same percentage of power reserve, or perhaps a very slightly greater, the single-engine installation could, for the same weight, be made so reliable that it would be quite as free from forced landings as the three-engined.

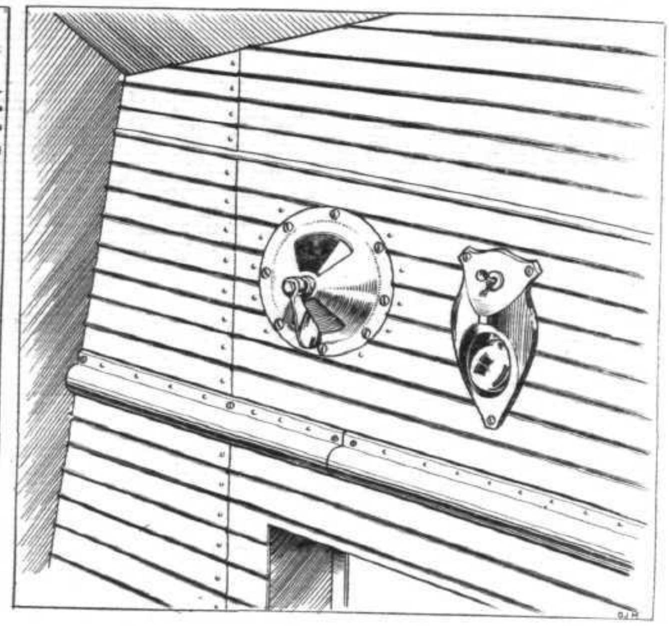
The argument does not really appear any nearer to being settled than it was several years ago, and in support of the single-engined power-plant system its advocates may point to the fact that the world's long-distance records have been established by single-engined machines. The whole problem being still very much open to discussion, and operational conditions, and consequently operators' requirements, differing materially according to the route operated, anything which can be done definitely to settle the vexed question, single or multi-engined aircraft, must be heartily welcomed. It is safe to say that nothing in modern times has promised to contribute so much towards a solution as the new "Viastra," recently finished by Vickers at the Supermarine works at Southampton. This machine, a brief illustrated description of which appeared in FLIGHT of June 27, 1930, has been very cleverly designed not only to take a wide variety of power plants, but to use these either in single units, in two units, or in three. Furthermore, the machine will shortly be available either as a landplane or as a twin-float seaplane. It would be difficult to imagine a simpler way of obtaining direct practical comparisons on the subject of power-plant installations. It might have been thought that to achieve this versatility the designers would have to make so many compromises that in one or other of its forms the machine would suffer from some drawback or other, either in performance or pay load. We have been privileged to examine the detail performance and weight estimates of the machine in a number of alternative forms, and in all cases both pay load and performance appear to be not only up to the average, but in many cases well above it.

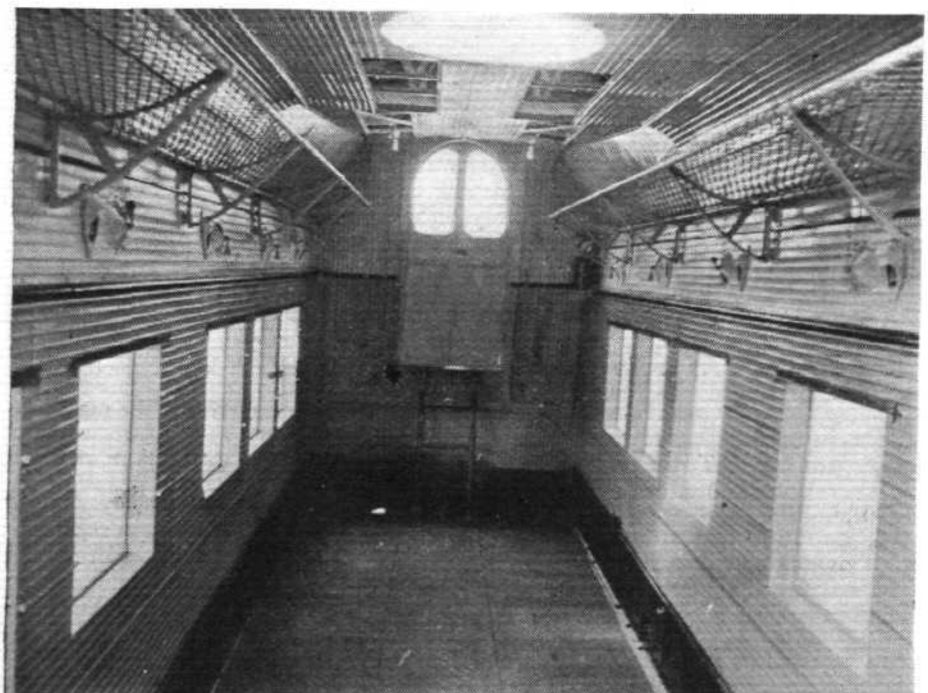
The first "Viastra" to be finished at Southampton and to undergo preliminary tests at Hamble before going to Weybridge for more exhaustive trials, is a three-engined machine fitted with Armstrong Siddeley geared "Lynx" engines. This machine, known as the Vickers Lynx Viastra I, has a tare weight (equipped) of 6,980 lb. (3,170 kg.) and a gross weight of 10,650 lb. (4,840 kg.), so that the ratio of gross to tare weight is 1·527; or, in other words, the machine carries as disposable load 52·7 per cent. of its tare weight. This is a good figure for a three-engined monoplane of high performance (cruising speed 120 m.p.h.). It is true that some years ago the Vickers designers produced a machine with an even better ratio, the "Vellore," but that machine was a single-engined biplane with relatively low performance and very low wing loading.

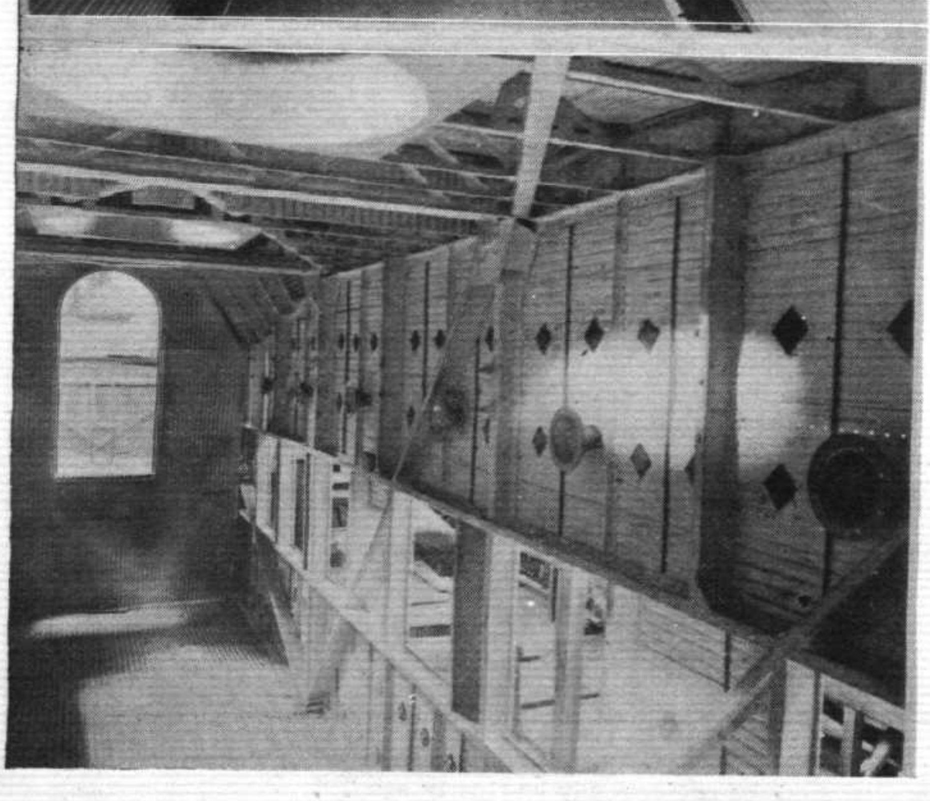
Taking the geared "Lynx" engine at 235 h.p. maximum, the disposable load of 3,670 lb. represents 5·2 lb./h.p., which must be regarded as a very economical figure for a machine with such a high cruising speed. The proportion of pay load to fuel load—or, in other words, range—can, obviously, be chosen to suit the requirements of the particular route on which it is intended to use the machine. With fuel for 300 miles at cruising speed (two-thirds

THE VICKERS LYNX "VIASTRA I": Side view. In the three-quarter front view at the top of the page the Townend rings around the engines may be clearly seen.







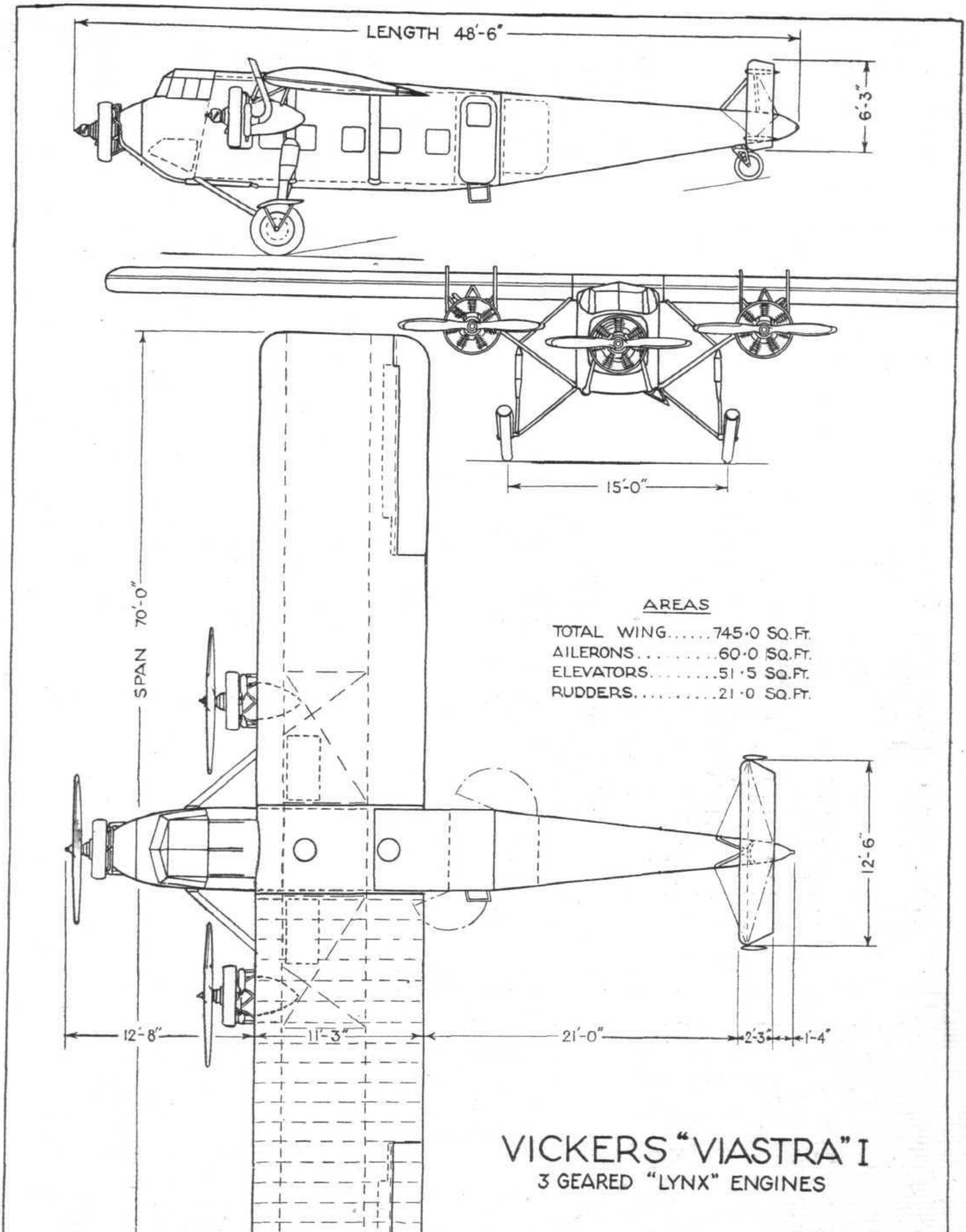


THE CABIN: The upper photograph shows the finished cabin, before the seats are installed, while the lower shows the cabin during construction. The sketches show details such as ventilators, etc. Small sand bags riveted to the metal covering are intended to prevent "drumming."
(Flight *Sketches.*)

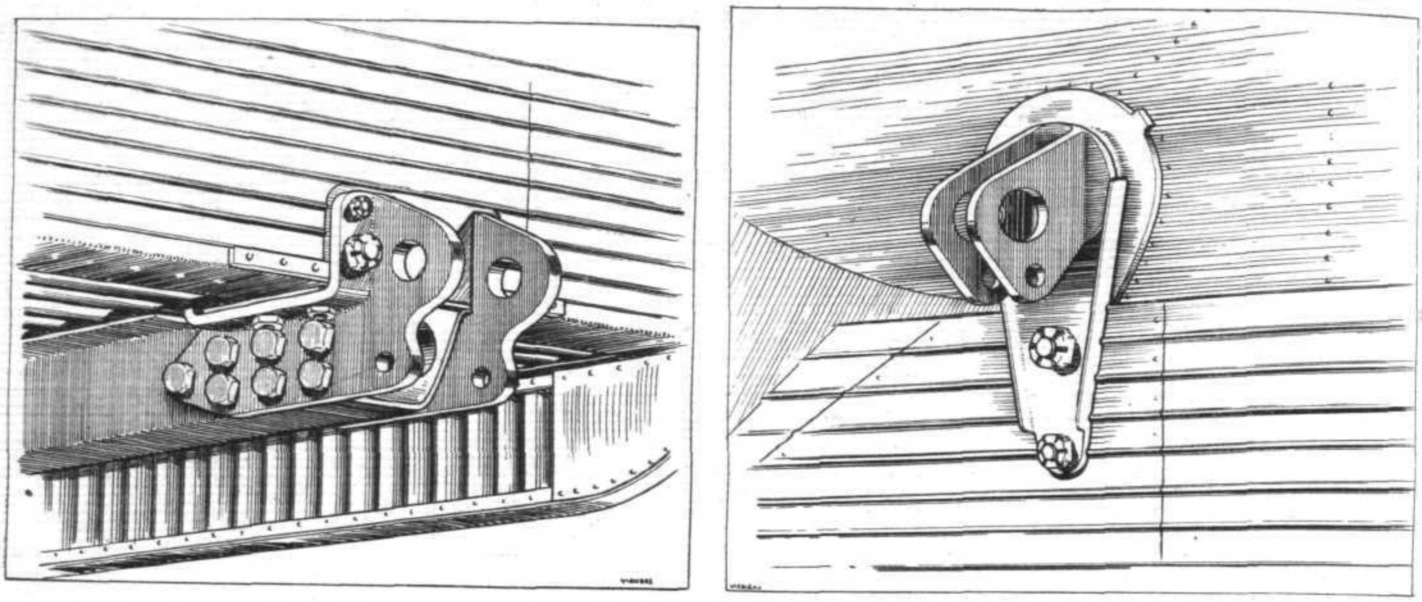
power) the pay load (*i.e.*, disposable load over and above weight of fuel, crew, etc.) is 2,460 lb., or 3½ lb. per horse-power (on maximum power). This range roughly corresponds to the London-Paris route with which most people are familiar, and thus gives a very good idea of the operational economy of the "Viastra I."

In aerodynamic design the "Viastra I" does not at first glance look very much out of the ordinary. It is a braced high-wing monoplane with wings of rectangular plan form and constant section. In view of the fact, however, that performance estimates indicate that a top speed of about 140 m.p.h. may be attained, the drag of the machine must be low. For example, assuming the estimated maximum speed of 140 m.p.h. to be attained, the Everling "high-speed figure" works out at 19·6, which is exceptionally good for a three-engined machine. It is to be assumed that the drag reduction resulting from fitting the engines with Townend rings has been taken into account in estimating the performance, and the effect of this reduction is presumably considerable, otherwise it is a little difficult to account for the low drag.

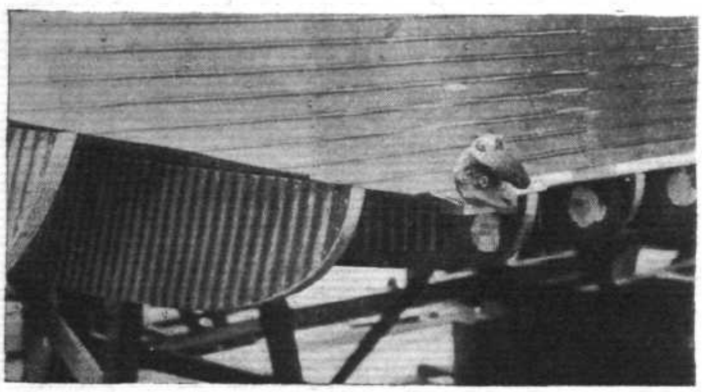
It is, perhaps, from a structural point of view that the "Viastra I" is most interesting. Designed to have a good ratio of gross to tare weight—or, in other words, a low structure weight, cheapness of production has been kept prominently in view, as well as a minimum of upkeep cost. The fundamental principle adopted in the structural design is that the skin or covering must take its part in the work of sustaining the loads. It will be recollected that some years ago Vickers Limited acquired the British rights for using the Wibault patented forms of construction, and that several machines were built closely resembling the original French design. Since then, however, Vickers have expanded and improved the Wibault system a good deal, and in the "Viastra" may be said to be incorporated the



THE VICKERS LYNX "VIASTRA I": General arrangement drawings. The machine will be available with different power plants, and in addition as a single-engined, twin-engined and three-engined machine.



ON THE "VIASTRA": On the left the fitting to which the bent axle and main wing bracing strut are attached. On the right the fitting on the upper longeron to which is attached the diagonal strut of the wing bracing. (FLIGHT *Sketches*.)



FUSELAGE DETAILS: This photograph shows the construction and placing of the formers which carry the cabin flooring. The fitting on the side is the anchorage for the radius rod of the undercarriage. (FLIGHT *Photo*.)

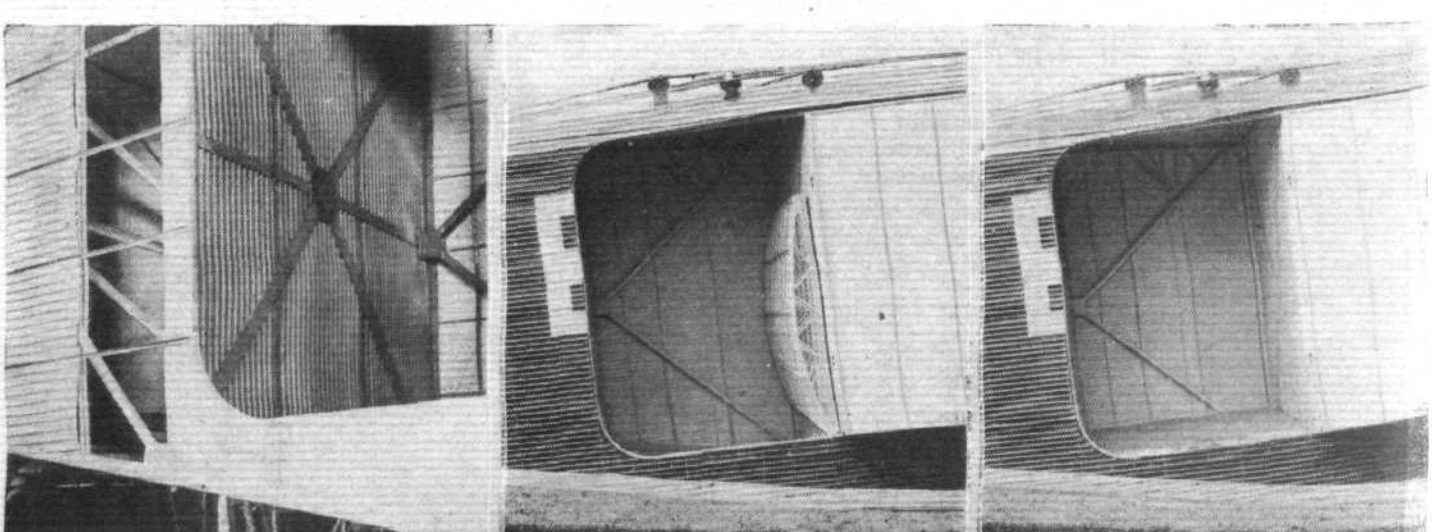
latest experience of the firm in truly all-metal construction.

The fuselage of the "Viastra I" incorporates a skeleton framework strong enough to carry its load, but needing the support of the metal skin to stabilise it. In a general way it may be said that the system consists in using Duralumin longerons of angle section, braced by vertical and diagonal Duralumin members of angle section, T section and channel section, according to local loads and stresses. Riveted to this framework is a Duralumin skin, put on in vertical strips having fore and aft corrugations for stiffening purposes. The production of these corrugated strips has been reduced to a very simple operation at the Vickers works, and the system helps very materially in cutting down the cost of production of the machine.

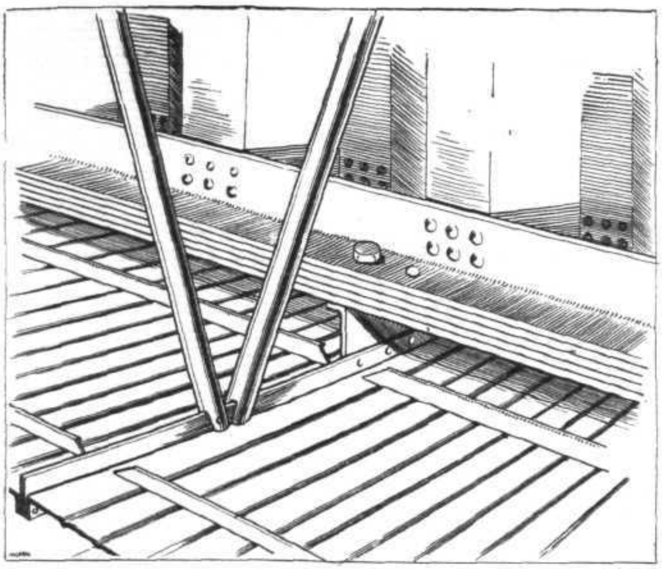
The floor of the cabin, etc., portion of the fuselage is strengthened by transverse floor bearers projecting downwards from the main fuselage structure. These bearers consist of top and bottom channels joined by a "wandering web" of a type similar to that used in the wing spars. The external covering, of corrugated Duralumin, is then riveted to the bottom of these floor bearers.

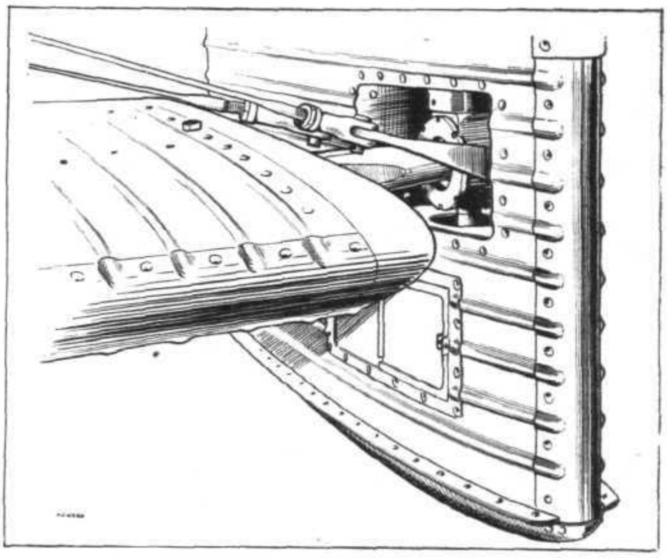
With the exception of the metal covering, and the difference in wing rib construction resulting therefrom, the wing construction of the "Viastra I" follows fairly closely that of previous Vickers machines. The system of wing construction has already been fairly fully described in FLIGHT (see issue of September 15, 1927), and it will suffice if we here confine ourselves to a brief summary of the features.

The main wing spars have flanges of flat Duralumin strip, laminations being added as and where local stresses demand. These flange strips are riveted near their edges to angle section corner strips, and the "wandering web," *i.e.*, a web of strip Duralumin which runs in zig-zag from front to rear face of the spar. By the fact that the web crosses in this manner, it forms diagonal diaphragms between the top and bottom flanges, and diaphragms of the ordinary type become super-



FUSELAGE DETAILS OF THE "VIASTRA I": On the left, the junction of rear to cabin portion before completely covered. In the centre view the false floor of the goods compartment is shown raised up, while on the right it is shown in place. This floor enables very heavy concentrated loads to be supported.





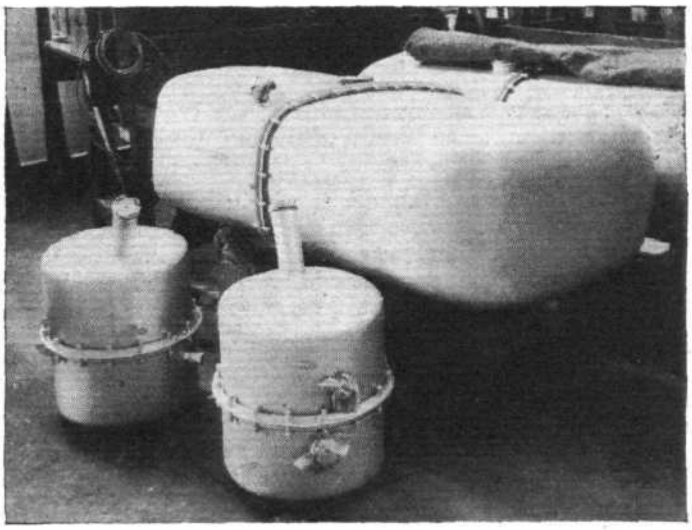
SOME "VIASTRA" DETAILS: On the left is shown the construction of wing spars and ribs, while on the right is a sketch of the unusual arrangement of the rudders. (FLIGHT *Sketches.*)

fluous. This type of spar has been found to give very good results from a strength/weight point of view, and is relatively very cheap to manufacture.

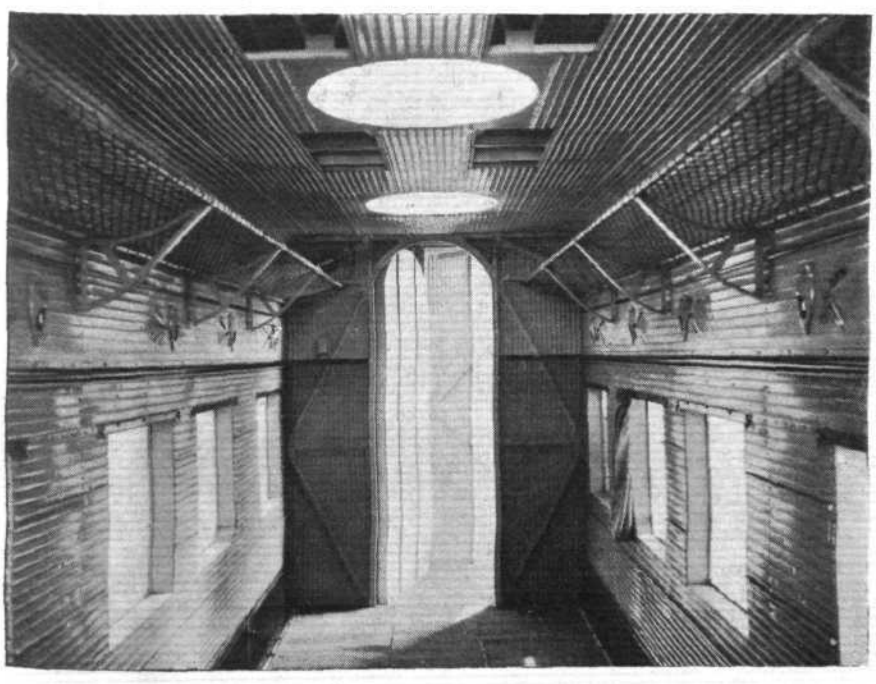
The wing covering in the "Viastra I" is in the form of Duralumin panels of standard width, corrugated in a fore and aft direction, and with the free edges at the sides of each panel turned up. These free edges are then riveted to the rib flanges, which are flat strips placed vertically. The construction will be clear from an examination of the sketch above, which shows a view inside the wing. The rib webs are Warren girders of Duralumin tube, slotted at the ends to fork the rib flange strip. It will be seen that the wing spars do not occupy in depth the whole of the aerofoil section, and that the rib flanges are supported from the spar flanges on simple bent plate clips. To stiffen the wing covering, angle strips running at right angles to the wing chord are placed at intervals. These strips are interrupted at the rib flanges, as shown in the sketch.

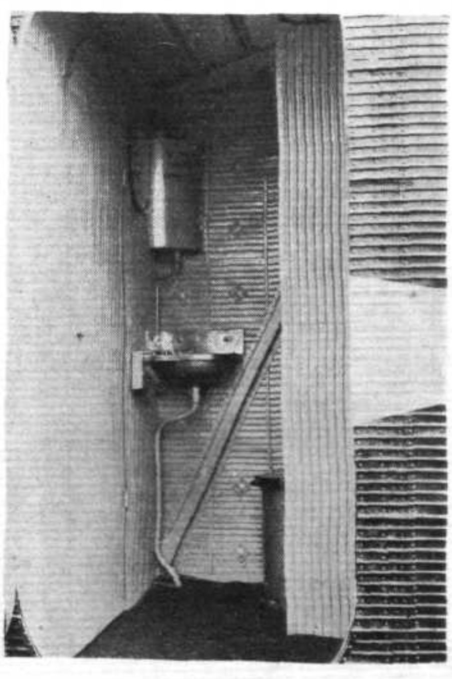
The centre section of the wing is built integral with the fuselage, the construction being visible in one of our photographs. The concentrated stresses from the wing spars are taken by a tubular structure in the roof of the fuselage, this structure taking the form of a plain transverse tube to which is attached the apex of a vee formed by two other tubes.

Externally the two wing halves are braced by steel tubes, the arrangement of which can be seen in the general arrange-

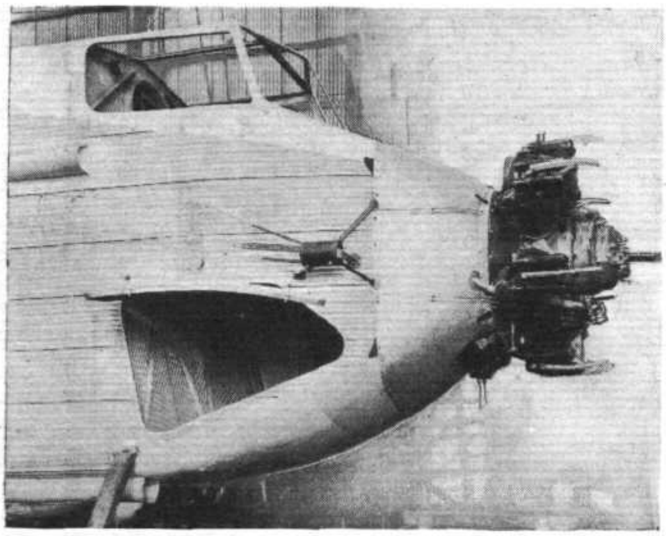


A NEW STYLE IN PETROL TANKS: In the "Viastra" Vickers use fuel tanks built up in two identical halves, joined in the centre by a flange coupling of novel design. (FLIGHT *Photo.*)

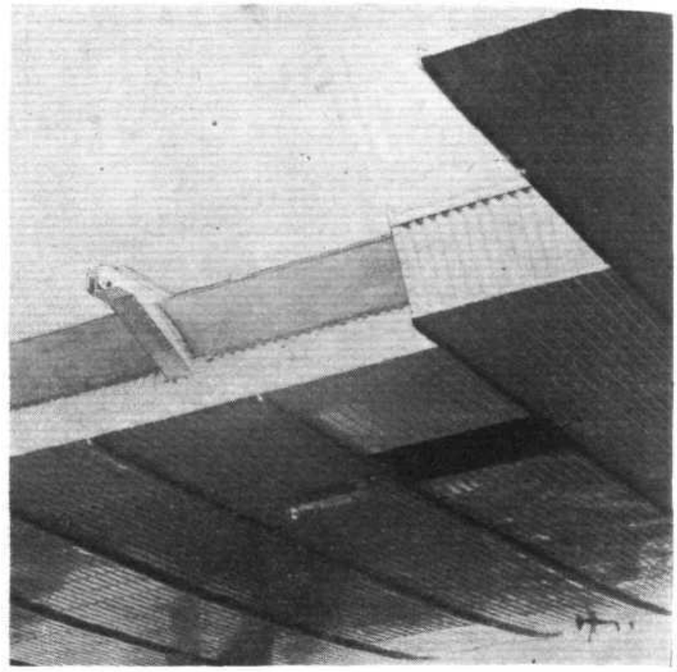




THE "VIASTRA" CABIN, LOOKING AFT: Note the roof lights. The door leads to the lavatory and exit (shown on the right).



NEARING COMPLETION: In this photograph, taken before the machine was finished, may be seen the central engine (Lynx), forward luggage compartment, and windscreening of cockpit. (FLIGHT *Photo*.)



FOR THE FRISE AILERONS: Photograph showing brackets on which the ailerons are supported. (FLIGHT *Photo*.)

ment drawings and photographs. From the point on the front wing bracing strut, to which is attached the telescopic leg of the undercarriage a diagonal strut runs to the top longeron of the fuselage.

Bristol-Frise type ailerons are fitted, the type of bracket supporting them being shown in one of the photographs above. The first "Viastra I" to be built is in addition fitted with Handley Page automatic slots.

The power plant of the "Viastra I" consists of three Armstrong-Siddeley geared "Lynx" engines of 235 h.p. each. The engine mountings have been so designed that a variety of different engines can be fitted, and the wing engines can be removed altogether and the machine used as a single-engined type. In that case the central engine will of course be one of much greater power than the "Lynx."

The petrol is carried in two tanks in the wings giving direct gravity feed. A new type of tank has been evolved and is we believe used for the first time in the "Viastra." This type of tank consists of two identical halves joined in the middle. At the joint the tank plating is flanged up and the two halves are held together by a series of bolts and slotted sleeves, with a packing between the two flanges to make a petrol-tight joint. The oil tanks are of different shape, but of the same form of construction. In the petrol tanks a loose framework inside serves both to strengthen the tank and to act as a baffle to prevent surging of the fuel. This framework is so designed that the two halves of the tank shell slip over it when the tank is being assembled.

The undercarriage of the "Viastra I" is of the "split" type, with oleo-pneumatic shock absorbers, Dunlop wheels and Vickers hydraulic brakes. These can be operated together or separately, and a tail wheel with castor action allows of turning the machine in a very small circle on the ground.

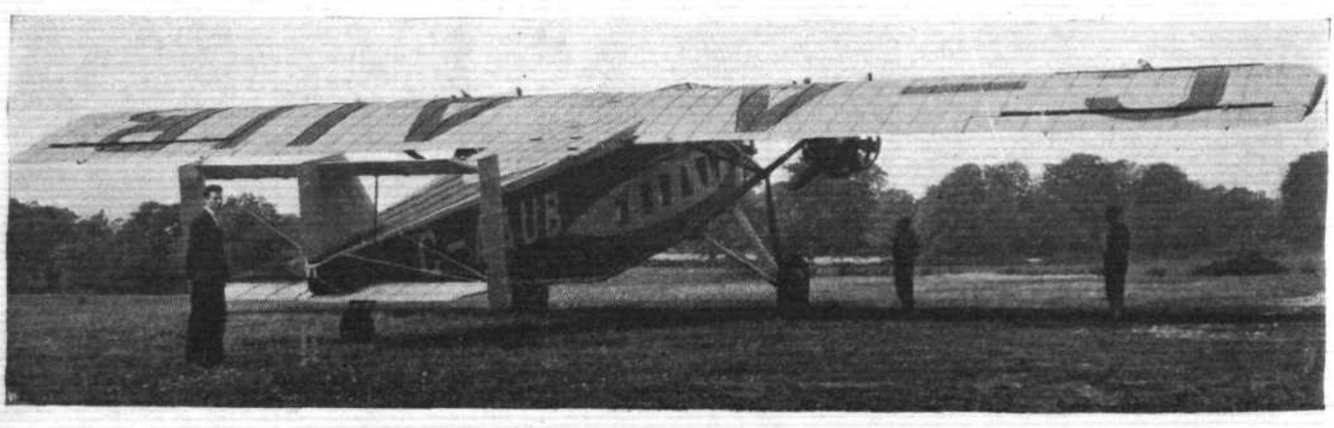
The biplane tail is of unusual design, in that it is, so to speak, of the single-spar biplane type. The two rudders at the ends of the horizontal tail surfaces are pivoted around vertical tubes which remain stationary, serving as the vertical struts of the biplane tail system. In construction, the biplane tail is very similar to the main wings, *i.e.*, of all-metal construction, even to the covering.

The cabin of the "Viastra" is of large dimensions (length, 20 ft. 3 in.; width, 5 ft.; height, 6 ft. 1 in.), and when the machine is used as a passenger carrier there is seating accommodation for 12 passengers, six along each side of the cabin. The ventilation system is novel, in that each passenger has an adjustable ventilation shutter placed near his seat. The windows can therefore be kept closed, which in itself reduces the amount of engine noise which reaches the cabin. With metal covering it was to be expected that "drumming" might be somewhat pronounced, and to reduce this the designers have introduced in each small panel in the fuselage wall a tiny bag filled with sand.

Aft of the cabin is the lavatory, very neatly arranged, with a door which alternatively shuts off the lavatory from the cabin, or, when passengers are emplaning or disemplaning, the lavatory from the entrance. Reached by a separate external door behind the lavatory is a large luggage compartment. This is fitted with a specially strong, false floor, which can be raised, as shown in one of our photographs.

The cockpit of the "Viastra" is ahead of the wing and well protected by windscreens. The view from the cockpit is good in all important directions, and when the machine is used as a twin-engined type, the view is, of course, even better. Dual controls are provided in front of the two side-by-side seats. A door in the rear wall of the cockpit communicates with the cabin.

As the "Viastra I" has not yet been through the type tests at Martlesham Heath, actual performance figures cannot be given, but it is thought that the estimated top speed of 140 m.p.h. will be reached, and it is certain that the estimated cruising speed of 120 m.p.h. will be attained.



THE VICKERS-LYNX "VIASTRA I": Three-quarter rear view.

PRIVATE FLYING AND CLUB NEWS

MR. GRIFFITH BREWER'S GARDEN PARTY

ON Wednesday, September 17, Mr. Griffith Brewer, the President of the Chartered Institute of Patent Agents, together with Mrs. Griffith Brewer, had a garden party at Hanworth Park.

Mr. Brewer has been connected with aerial matters since the very early days. During the latter part of last century he was an ardent balloon pilot, and from the very earliest days he has been connected in a business capacity with the Wright Brothers. He was instructor on the observation balloon and airship side at Roehampton, and he actually made his first balloon ascent 39 years ago, with the late M. Auguste Gaudron, who, at a later date, beat all the world's records for long-distance flights overseas with Maj. C. C. Turner, and the British distance record with the late Air Commodore E. M. Maitland and Maj. Turner in 1908 Mr. Brewer won the International Balloon Competition from Hurlingham, and he has taken part in many Gordon Bennett races. In 1908 he also achieved the distinction of becoming the first Englishman to fly by going up with Wilbur Wright in France. In 1912 he was entrusted with the formation of the British Wright Co., to take over the Wright patents in England. In 1914 he went to Dayton, and at the Wright Flying School he took his pilot's ticket just after the outbreak of war. Mr. Griffith Brewer is the oldest member of the Council of the Royal Aeronautical Society, having joined it in 1903, and for ten years after the start of the Royal Aero Club was a member of its committee.

Mr. Griffith Brewer in front of his new Moth (Gipsy I).

In 1916 he delivered the first Wilbur Wright Memorial Lecture before the Royal Aeronautical Society.

The Garden Party, which was the official party given by Mr. Griffith Brewer in his capacity as President of the Chartered Institute of Patent Agents, is probably the first occasion of a chartered institution meeting being held at an aerodrome, and is certainly the first occasion upon which all the guests at such a meeting have been given the opportunity of taking a flight in an aeroplane. Actually some 207 took advantage of this opportunity, and four Desoutters, a Moth and the N.F.S. D.H.61 Leone were engaged in getting this number up in the time available.

During the afternoon Mr. Brewer took a small party over to the lock-up, where he keeps his Moth, and showed them how simple the operation of a light aircraft is; for, with the help of one assistant only, he opened the lock-up, got out his machine, started up, took-off, flew a circuit, landed again, and shut up the lock-up all in 18 minutes.

It is also interesting to note that the hostess, Mrs. Griffith Brewer, is herself a pioneer, as she was the first woman to cross the Channel by air, having gone across in a balloon on February 20, 1906.

Mr. Brewer is to be congratulated on the keenness for aviation which he has undoubtedly instilled into a large number by this innovation, and we hope that his magnificent example will be followed by many.

Among the acceptances for the garden party were:—Capt. F. L. M. Boothby and Lady May Boothby; Air Vice-Marshal Sir Sefton Brancker; Major J. S. Buchanan and Mrs. Buchanan; Sir Alan Cobham, Lady Cobham and children; Lt.-Col. M. Ormonde Darby; Lt.-Col. Ivo Edwards and Mrs. Ivo Edwards; Sqd.-Ldr. T. H. England and Mrs. England; Mr. F. Handley Page and Mrs. Handley Page; Mr. J. E. Hodgson and friend; Sir William S. Jarratt and Lady Jarratt; Dr. Lachmann and Mrs. Lachmann; Capt. Lamplugh and Mrs. Lamplugh; Mr. F. A. Manning and Mrs. F. A. Manning; Air Commodore E. A. D. Masterman; Mr. H. Massac-Buist and Mrs. Massac-Buist; Major R. H. Mayo and Mrs. Mayo; Lt.-Col. J. T. C. Moore-Brabazon and Mrs. Moore-Brabazon; Mr. J. Lankester Parker; Air Commodore C. R. Samson and Mrs. Samson; Dr. Vilhjalmur Stefansson; Lt.-Col. H. T. Tizard and Mrs. Tizard; Major C. C. Turner; Sir Henry White-Smith; and Mr. Howard T. Wright. In all, some 325 accepted.

THE HANWORTH CLUB meeting, which was to have taken place on Saturday, September 27, has now been cancelled owing to the uncertainty of having a reasonably fine day at this time of year. Instructional flying will, of course, be carried on as usual.

ON THURSDAY, September 18, the Nottingham Club held their first social evening. This club, which has been taken over by the N.F.S. organisation, is now rapidly going ahead. Previous to coming to Tollerton aerodrome they were at Hucknall, where they had the use of the R.A.F. aerodrome and one of the disused outbuildings. This building was hardly to be compared with the present clubhouse, which has been erected by N.F.S. and is one of their standard provincial type, with a large dining-room and sitting-room divided by a movable partition, the removal of which makes the two rooms into an excellent ballroom. The floors in each case are of oak parquet, which makes them admirable for the purpose. The aerodrome at Tollerton has been provided by the municipality, and though it cannot at present be said to have a perfect surface, is well situated and quite good enough for club instructional work and the type of traffic likely to use it for some years. The evening, of course, included a well-patronised dance, and the arrangements made by the committee amply provided for the comfort of all the guests, who numbered some 80. Mr. Shepperd, the club instructor, together with Mrs. Shepperd, arranged several competitions during the evening, not the least amusing of which was a beauty competition for the men; this was won by a tall fair-haired Adonis, and the prize is said to have squeaked with joy, emitting a sound not unlike a small siren.

THE LLANDUDNO Flying Week, which was organised by the Llandudno Seasons Attractions Committee together with Northern Air Lines, Ltd., of Manchester, was held during the past week, and, owing to the unprecedented demand for joy-rides, this particular form of amusement will continue during the present week as well.

Llandudno must be one of the most air-minded towns in the country, for, in spite of the rain which fell more or less continuously every single day during the week, and in spite of the extremely rough weather, some 500 people were taken up every day. Northern Air Lines were running five Avros there, and these were all kept very busy.

On Friday the Town Council gave a dinner at which several aerial visitors were present, including Sir Sefton Brancker, Miss Spooner, Mr. Leeming and other representatives of Northern Air Lines, Flt. Lt. T. Rose, and Mr. B. Wilson. During the night the weather got worse and worse, and the prospects for the following day were not good. An excellent programme of the usual flying meeting type had been

arranged, and it was hoped that many more guests would arrive. When Saturday dawned, however, it was seen that flying conditions were rapidly getting even worse, and no great surprise was occasioned when telegrams from most of those who had intended coming arrived saying that they could not get through. During the afternoon, however, two machines did arrive, showing that "where there was a will there was a way." The first of these was Col. Strange, a director of the Spartan Aircraft Co., of Southampton, who came in one of his three-seater Spartans (Gipsy II) at about 12.30 p.m. Shortly afterwards Mr. C. S. Napier landed in his Westland Widgeon (Gipsy I). Both said that they had had a pretty rough trip, but that conditions were not quite so bad as weather reports had made them out to be. Mr. Napier had actually got as far as Hooton the previous night and had come on from there, while Col. Strange had come across from Nottingham, where he had been dilating on the merits of a three-seater versus a two-seater during the previous evening.

Owing to the rain and rough weather, the programme as previously arranged had to be modified, but the interest provided was no less real on that account. Mr. McKay got an Avro on its back, and, judging from the remarks we heard, this was evidently the first time such a thing had been seen in Llandudno—indeed to goodness, yes and all. Flt.-Lt. T. Rose threw his new Sports Avian about, which spoke well both for the controllability of this type of machine and for his own powers of controlling it, and subsequently he provided in his usual inimitable manner the comic part of the show, when he varied his "bottle-necking" stunt by shooting at balloons with a small pistol. The noise of this weapon could not be heard above the roar of his engine with stub exhausts, but it is understood that it really was fired, and certainly many reports reached us next morning of pistol shots which had been heard in most unexpected places during the previous evening. Of course, there may be no connection between the two, but stories were told of certain reverend gentlemen who were greatly relieved to find that their anatomies had suffered no material damage other than that which was occasioned when sundry explosions caused them to swallow, somewhat hurriedly, their portions of Welsh sheep, and since this marksman is known to have a great fondness for gaiters, we can but put two and two together.

An event which caused some excitement was the Llandudno Handicap race. The entrants were Col. Strange, Mr. Napier, and Flt.-Lt. Rose. The latter had the misfortune to suffer a split propeller just after taking off, and consequently he had to land again. The other two made a good race of it, and Col. Strange was just beaten on the post. Mr. Kingwill, who did the handicapping, is, we gather, not likely to apply for a position instead of Capt. Dancy and Mr. Rowarth; he prefers less nerve-racking pastimes, like flying a Moth with his hands held above his head while his bowler hats are constantly getting blown off—at least, that's what he said after giving one of the best shows we have seen him give for a long time. He was the originator of this particular form of nonsensical flying, and certainly his turn is always screamingly funny. He is a past-master at handling his machine in impossible positions, and his representation of an amateur in difficulties is worth going all the way to Manchester to see.

A further comic turn was provided when a happy (?) couple took their large family for an airing in a car on the aerodrome. The weather provided much unexpected help to their show by constantly carrying away their umbrellas, etc., and the rain made certain that their short trousers were quite uncomfortable after their parents (?) had knocked them down several times. Finally, after making the crowd convulse with laughter, the ubiquitous Moth arrived and bombed them off the aerodrome. As a finale an oil-well was well and truly shot up by numerous "Arabs" and set alight; aircraft, however, came to the rescue with the latest in fire-extinguishing apparatus and, after bombing off the Arabs, put out the fire. Northern Air Lines are to be congratulated on their enterprise in getting the Attractions Committee to co-operate with them and to prepare the landing ground in their endeavour to increase the attractions for visitors to Llandudno, and it is to be hoped that their Avros, which seemed to work from dawn till dark, will provide all the remuneration which their work entitles them to.

A DESOUTTER Mark II made the fastest time of the Concourse de Grande Vitesse at the 11me Meeting International de l'Antwerp Aviation Club, September 13-14-15, and also won the third prize for aerobatics at the same meeting.

This latter prize was rather amusing. Mr. Styran, the pilot, had no idea that he was competing in an aerobatic display; but having seen a well-known German give a demonstration of aerobatics, he decided to go up and show them what he could do with an ordinary British cabin aircraft. On landing, to his great surprise he was presented with the third prize for aerobatic display.

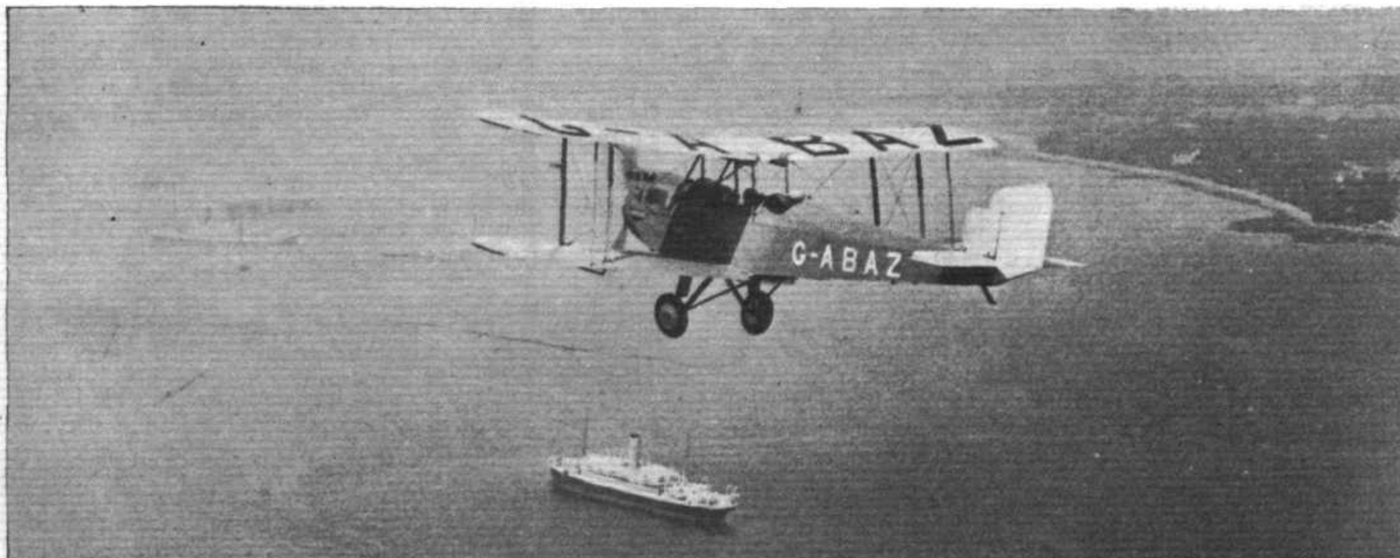
Other English visitors to this meeting were Mr. Jackaman, in his Puss Moth (Gipsy III), who won some four prizes, after having a hectic journey from Berlin. In spite of the very rough weather, his passengers found the ventilating arrangements of the machine admirable, also Flt.-Lt. T. Rose, on a Sports Avian (Hermes), who came away with six prizes, including second in the aerobatic competition and first in the take-off and landing competition.

Miss Winnie Brown, in her Avian (Cirrus III), won the arrival competition and also gained three other prizes. So the English contingent distinguished themselves by gathering a large percentage of the total prizes!

A USEFUL index of the steady growth of private flying is afforded by an analysis of the figures for the operations of the Brooklands School of Flying during January-August of last year and January-August of this year.

The figures for this year show an increase in dual instructional hours flown of 48 per cent., and of solo hours flown of 41 per cent., while the total figure for "joy rides" shows an increase of 56 per cent. The number of pupils on the Register was doubled, the number of "A" licences increased by 300 per cent., and of aircraft sold by 400 per cent.

The average cost to the *ab initio* pupil of an "A" licence works out at £42 10*s*. during 1930.



A Spartan 3-seater (Gipsy II) flying over Southampton Water.

AIRISMS FROM THE FOUR WINDS

England-Australia Flight

CAPT. F. R. MATTHEWS, who set out from Croydon on September 16 in a D.H. "Puss Moth" with the object of beating Bert Hinkler's time for a solo flight to Australia, has—at the time of writing—obtained a day's lead. Having reached Belgrade in the evening of the first day, Matthews was held up by bad weather the next morning and could not reach Sofia, as originally planned. He resumed the flight on September 18, however, and landed at Sofia in the morning, then proceeded to Constantinople, arriving there in the evening. The journey was hampered by bad visibility and storms. He was off again early next morning for Aleppo, and reached Ramadi on September 20. Flying by night via Baghdad, Matthews made rapid progress down the Persian Gulf, arriving at Jask at 2 a.m. on September 22. He set out again two hours later for Karachi, but had to make a forced landing on the Persian Gulf, and did not reach Karachi until the evening. He was thus nearly a day ahead of Bert Hinkler, but was several hours behind Miss Amy Johnson's time. On September 23 he left Karachi, and arrived at Allahabad in the evening and Calcutta on September 24.

The Master of Sempill's Scandinavian Tour

THE Master of Sempill, who has been touring the coasts of Sweden, Norway, and Finland in his "Puss Moth" seaplane, concluded his successful programme on September 22 with a magnificent flight home over the North Sea from Stavanger to the Scottish coast. The Master of Sempill, who flew solo, made landfall at Cruden Bay, after 3 hrs. 30 min. flying, then turned south for Aberdeen, where he arrived 15 minutes later.

Croydon-Kenya Flight

MR. KENNETH SHENSTONE and Mr. Pat Fairbairn (of Australia), two Cambridge undergraduates, left Croydon on September 17 in a D.H. "Moth" in an attempt to fly to Kenya and back. They reached Marseilles that evening having stopped at Paris and Lyons for fuel. Next day they flew to Naples.

The Canadian-Atlantic Attempt

CAPT. ERROL BOYD (*ex* R.A.F.) and Lt. H. P. Connor, who are attempting a flight from Canada to Croydon (via Newfoundland) in the Bellanca monoplane *Miss Columbia*, flew from Charlottetown, Prince Edward Island, to Harbour Grace, Newfoundland, on September 23.

The Prince of Wales

THE Prince of Wales, travelling incognito, flew from Berck to Le Bourget, on September 19, in his private aeroplane, piloted by Flight-Lieut. Fielden and accompanied by Gen. Trotter. The Prince flew back to London on September 24.

French Flight to Persia

Two French airmen, Goulette and Lalouette, left Le Bourget, on September 19, for Teheran, arriving at Bucharest the same evening. They reached Aleppo the next day, and arrived at Teheran on September 21.

Belgian Air Squadron's Visit to England

NEXT week five machines of the Belgian Military Air Corps will pay a flying visit to England, where they will be the guests of the R.A.F. for a week. They will be accompanied by Gen. Gillieaux, G.O.C., Belgian Military Air Corps, first flying to Manston aerodrome on Monday, September 29. After an official reception they will visit the R.A.F. School of Technical Training and No. 9 (Bomber) Squadron, both of which are stationed at Manston. Tuesday will be spent at Bircham Newton, near King's Lynn, where they will see No. 35 and No. 207 day-bomber squadrons. On Wednesday, a visit will be paid to the Royal Air Force Practice Camp at Catfoss (Yorkshire), and they will fly down to Cranwell (Lincolnshire), where they will visit the Royal Air Force College. Then, next day, the visitors will see No. 2 Fying Training School at work at Digby (Lincolnshire), and in the afternoon will fly south to Upavon (Wiltshire), and the following day will see there Nos. 3 and 17 fighter squadrons equipped with the latest and fastest fighting aircraft in the R.A.F., the Bristol "Bulldog." They will then fly to Eastchurch and will visit No. 33 (Bomber) Squadron, which is equipped with the Hawker "Hart." On Saturday they will fly back to Belgium.

TO THE "FATHER OF AVIATION": The memorial to M. Clement Ader, who in 1899 was the inventor of the first aeroplane to rise from the ground, was unveiled on September 21 at Muret (his native town) by M. Laurent Eynac, the French Minister for Air. The monument was designed by the sculptor Landowski.

Australian Pilot Killed

MR. DAVID SMITH, the young Australian pilot who, in company with Lieut. Shiers, attempted a flight from Australia to England in a Ryan monoplane early this year, was killed in a flying accident on September 17 at Sydney. He had just started on a flight—according to some reports in a "Tiger Moth" monoplane—when his engine suddenly stopped at an altitude of about 150 ft. Smith either jumped or fell out of his machine, which was stated to be travelling at about 180 m.p.h., for his body was picked up in a garden 50 ft. away from where the machine crashed in a street.

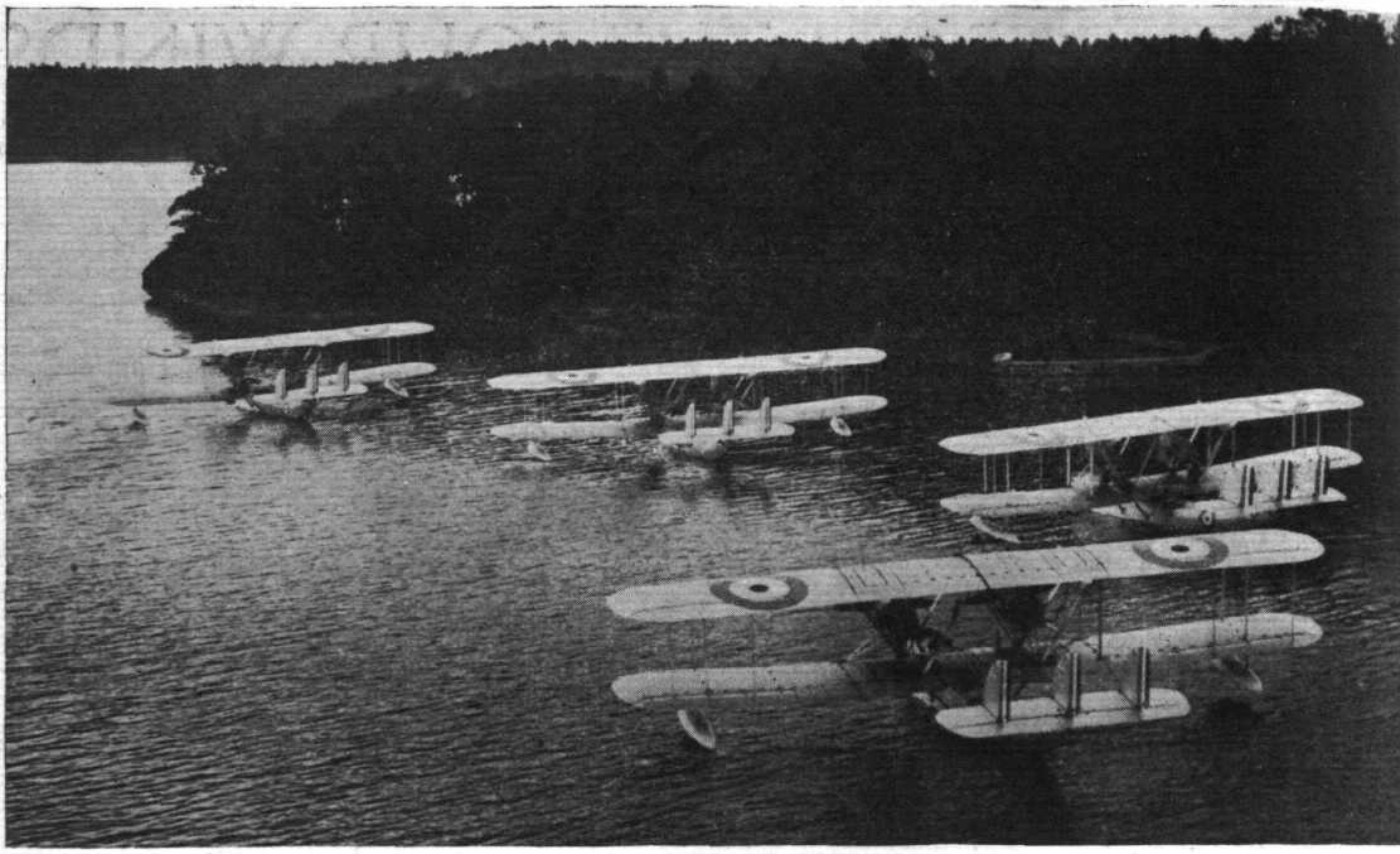
Airman Hook Fund

IT has been decided to close the Airman Hook Memorial Fund, which was opened to help the dependants of Mr. Eric Hook, who lost his life in the Burmese jungle while trying to fly to Australia with Mr. James Matthews last July. The fund has realised £1,652 12*s*. 2*d*. Mr. Hook left his wife and two children—Noni, aged 4½, and Helen, aged 2½—unprovided for. An appeal was made on behalf of the family through *The Daily Mail* by the Rev. Charles J. Barry, of Emmanuel Church, West Wickham, Kent, and among the contributors was Miss Amy Johnson, who sent £100.

Mr. Matthews, who escaped disaster, arrived back in England on September 15.

Unnecessary Air "Stunts"

ALTHOUGH it was only a little while back that the German pilot Hundertmark met with a terrible death while attempting the rather senseless "stunt" of changing 'planes in mid air, a similar performance was repeated at Stuttgart on September 18, and another disaster resulted, with the loss of four lives. Fritz Schindler, in a Flamingo biplane, after several unsuccessful attempts to grasp a ladder lowered from a Klemm monoplane flying above, eventually got a hold, and was about to climb up the ladder when the latter caught in the lower machine. The two machines crashed to the ground together, Schindler being thrown off and falling on to a house. One of the pilots jumped with his parachute, but this got entangled with the falling machines, and he and two other occupants of the 'planes were killed. There is, we fear, little hope that even this appalling accident will have much effect in stopping these unnecessary and senseless stunts.



THE R.A.F. BALTIC CRUISE: The four Supermarine "Southamptons" of No. 201 Squadron at Stockholm.

The R.A.F. Baltic Cruise

THE four Supermarine "Southampton" flying boats of No. 201 (Flying Boat) Squadron under Grp.-Capt. Nanson, which is making a month's cruise in the Baltic, reached Riga from Tallinn (Reval) on September 18. They were escorted by Latvian seaplanes, and alighted at Kishlake, where an official welcome was given by military officials and representatives of the Latvian Government. A special programme was arranged for the entertainment of the visitors.

Vatican State at Air Congress

ACCORDING to the Rome correspondent of *The Times*, the Vatican State has accepted an invitation to attend the International Air Congress, which will be opened in Budapest at the end of this month, and will be represented there by the Papal Nuncio, Mgr. Rotta, and by Signor Angelini Rota, one of the Vatican judges and legal counsellors. This will be the first occasion upon which the Vatican State has attended an aeronautical congress.

Miss Ruth Alexander Killed

MISS RUTH ALEXANDER, the American airwoman and holder of the women's altitude record of 26,600 ft., was killed on September 18, when her light monoplane crashed into a hill during an attempt at a trans-Continental flight from San Diego to Newark.

A Forthcoming Venture

THE Blackburn "Bluebird" light aeroplane, fitted with the latest Gipsy II engine, which the Hon. Mrs. Victor Bruce is using for her "mystery" flight, is shown here. The space usually occupied by the passenger is being used for extra petrol tankage, bringing the total quantity of petrol carried to 90 gals. Her machine also carries an automatic wireless set, fitted by Messrs. Graham Amplions, with a special key, in the construction of which Mr. Hankey has given considerable assistance. This set will send out a signal every quarter of an hour, on a wave of 35·1 m., Mrs. Bruce having a choice of five different signals. Under favourable conditions, the range is as much as 12,000 miles. It is of interest that no mechanical knowledge of wireless is necessary, as the message is sent out by clockwork motor.

Another innovation is the dictaphone, which will enable Mrs. Victor Bruce to record her impressions actually whilst in flight.

The machine is also fitted with a Reid turn indicator.

The total weight of the machine fully loaded, for which it has obtained a certificate of airworthiness, is 1,950 lb. It is painted silver and light blue, and the Hon. Mrs. Victor Bruce has christened it *Bluebird*.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

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CONTENTS

FLYING BOAT DEVELOPMENT FOR SPEED RESEARCH.

By W. G. Carter, M.B.E.

It may be recollected that in the issue of The Aircraft Engineer, *of February 28, 1929, Mr. Carter, who designed the Short "Crusader" Schneider machine, suggested, as an immediate possibility of obtaining increased speed with existing power plants, the small central-hull flying boat with engines placed in tandem. Mr. Carter's 1929 design used outboard floats for lateral stability on the water. He has now, in order to obtain a further increase in speed, turned his attention to a somewhat similar machine, but with short wing stubs of the type regularly used by Dr. Dornier in all his flying boats. Personally we cannot say that we are in favour of this form of stabilising a flying boat hull, more especially in the case of a racing machine in which the torque-reaction may attain a very high value if one engine cuts out while the machine is running on the water. Mr. Carter has, however, devised an ingenious scheme by which he is certain that this difficulty can be overcome. That invention is not mentioned in the article, but should be referred to here in order to point out that, for the purpose of the article, criticism of the wing stubs should not be used to invalidate the rest of Mr. Carter's arguments.*

On several occasions since the inception of speed contests for racing aircraft, flying boats have competed successfully with other typical examples of float seaplane construction. It is only during more recent events of this nature that machines have conformed more or less to a common standard, in which the claims of the boat type for representation have been disregarded. In consequence, research and experiment has been mainly concerned with float machines, and equally important phenomena associated with flying boat development has been denied the advantage of this critical attention. So far as the writer is aware, in no case have the speeds attained by specially constructed seaplanes been anything like approached by other types of marine aircraft. There accordingly remains much leeway to make up, if and when, competitors are selected on a more comprehensive basis. An outstanding advantage of twin floats is that stability on the water is an inherent circumstance of their construction. Unlike the flying boat it admits no further variation for this purpose. In the latter case opinion is divided regarding the relative merits of attaching small auxiliary floats to the planes, or the alternative method of using stub floats forming part of the hull structure. Each device at the present time shares the distinction of considered support.

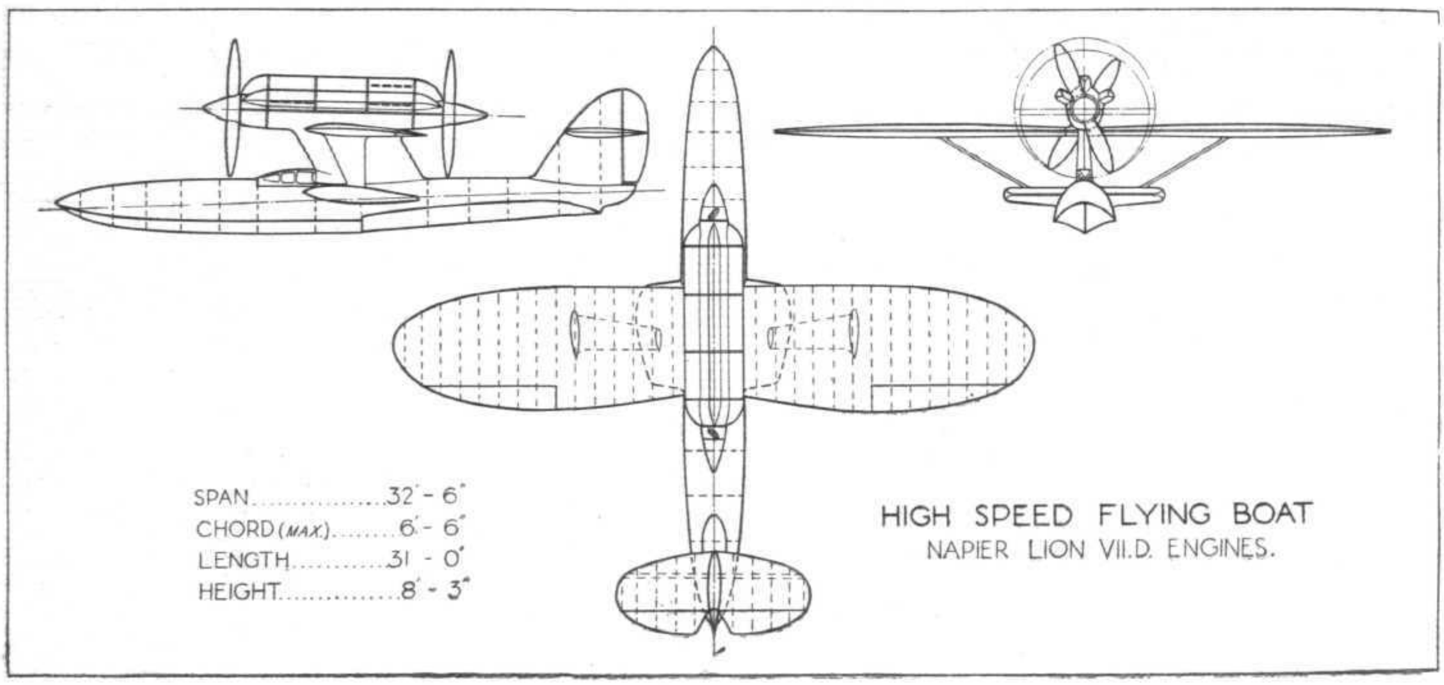
In regard to machines now in general use for racing purposes, these have narrowed down almost without exception to twin float biplanes, or their counterpart, the low wing, wire braced monoplane. An intensive period of international competition has been responsible for producing a variety of these types, modified as occasion demanded to keep step with the construction of more highly developed aero engines. These in turn have done much to account for the improved performance that has been so marked a feature in successive spectacular events. While there still remains room for further refinement in detail, the scope in this direction has become extremely limited. Substantially to increase the speed range therefore depends almost entirely on the construction of still more powerful engines. If these are not readily available, some radical change in the design of racing craft may at least be anticipated.

In considering the present stage of racing engine development, what has been done to increase output per unit of cylinder capacity, is little more than a prelude to ultimate improvement. Much the same outlook may aptly apply to the aeroplane. The distinction however, is somewhat invidious. While in the case of aero engines, both direction and extent are either known, or have been visualised, little corresponding encouragement is derived by surveying the field of possible aerodynamical progress. Experimental research has already provided a striking example of later engine development. Similar investigation with aircraft is largely restricted to improved streamlining in order to decrease the power used during flight.

Perhaps the more noteworthy departures from orthodox machines, constructed during recent years, were those prepared by Italy to contest the Schneider trophy during 1929. A tandem engined arrangement was used by Savoia Marchetta, the pilot being seated between the two engines, and the tail unit mounted on supports attached to the extremities of twin floats. Also distinguished by originality in conception, the Piaggio held promise of outstanding performance. No indication of the capabilities of either machine has been given. It is conceivable that immediate success may not

have attended their early trials. In constructing these machines, however, the implied intention to evolve, develop, and possibly establish an improved type for use on future occasions, is somewhat significant.

Some time ago, when reviewing the development of racing craft the writer briefly considered duplicating the power unit, associating this arrangement with a central hull stabilised by auxiliary floats attached to wings. It was assumed that with twice the power normally available, the proportionate increase in resistance would not be similarly affected. A type of this description is by no means an innovation even for high speed contest. One, incidentally a non-starter, appeared at Cowes during 1923, mounting two 400 h.p. Lorraine-Dietrich engines in tandem. As a speed machine, however, its development at that time was hardly comparable to some of the single-engined seaplanes



competing in the same event. It serves to emphasise that the contrast between present day aircraft and their prototype, lies principally in detail, the type arrangement is not easy to dissociate.

In the present instance, the former scheme has been further simplified. The disposition of the planes in relation to the thrust centre is similar to the standard float monoplane. Stability is obtained by stub floats. A method usually employed in bracing the structure of float seaplanes, comprises four struts and an average of sixteen wires. In the type illustrated, the four chassis struts are replaced by a central member and the bracing wires are superseded by two struts connected to the wings, then, converging through the stub floats to meet in the central hull. This arrangement not only provides a more rigid structure, it also excludes the necessity of constant rigging and adjustment to the supporting surfaces. As speeds are further increased, it is likely that the elimination of stream line wires will become more imperative. Their individual effect and indirect contribution to resistance is known to be much greater than appearance or size would suggest, while yawing, vibration, and the possibility of fracture, are unpleasant features accentuated by their use under high speed conditions. Some of the main characteristics of this machine are as follows:

With two Napier Lion Engines (VIID) the weight with full load has been provisionally estimated to be 5,950 lb. This figure allows for the provision of 115 gallons of fuel, or sufficient to complete a course of 220 miles. Accounting largely for the low weight ratio, and emphasising some advantages of this method of construction are:—

(1) The disposition of material is more economically arranged in the central hull than in two floats.

(2) No fuselage extension.

(3) Higher speed requires proportionately less fuel per engine.

(4) Fuel tanks in one unit and simplified fuel system.

(5) Many items are unaffected by the dual installation.

(6) The influence of structure weight percentage as to the collective effect of above.

Regarding the resistance of individual components, the figures here given, although empirical, may be considered sufficiently accurate for the present purpose. Three representative types are included, in order to make comparison more readily direct. Drag units are in lb./100 ft./sec.

(A) A single engined float machine assumed to weigh 3,550 lb.

(B) The machine illustrated.

(C) One similar in construction, except for certain modifications in order to substitute wing floats.

Item.	A.	B.	C.
	lb.	lb.	lb.
Floats	9·5	—	—
Hull with stub floats	—	19·4	—
Hull with wing floats	—	—	14·5
Planes	14	22·6	22·6
Nacelle or fuselage	8	7	7
Tail unit	3	4·5	4·5
Chassis struts	5·5	—	—
Central member & head fairing	—	5·1	5·1
Wing struts	—	3·5	3·5
Bracing wires	9·5	—	—
Total drag (100 ft. per sec.) ...	49·5	62·1	57·2
Power available	1,300	2,600	2,600
Estimated T.H.P.	1,070	2,140	2,140
Speed M.P.H.	335	390	400
Average speed M.P.H. (closed circuit)	318	370	—
Time for 220 miles (minutes) ...	41·5	36	—
Power/weight ratio (lb. per B.H.P.)	2·7	2·3	—
Plane area (sq. ft.)	110	180	—

An effect of the time ratio, its influence on the amount of fuel required, and so in reducing weight, is of interest. It shows that both engines need only 76 per cent. more fuel than would be necessary for a single-engined machine to complete the same course.

A more detailed analysis of the hull arrangement *versus* two floats is appended, to indicate how the alternative methods of stabilising the machine affect performance.

Floats for (A)

Displacement (each)	2,925 lb.
R.B.	0·65
Cross sectional area (each)	3·7 sq. ft.
Length	21·5 ft.
Drag (100 ft. per sec.)	4·75 lb.

Hull with Stub Floats. (B)

As a precautionary measure R.B. has been increased from 0·65 to 0·72.

Displacement of hull and stub floats ...	10,250 lb.
Displacement of stubs	2,000 lb.
Displacement (hull only)	8,250 lb.
Displacement ratio to one float ...	2·8

Multiplying the sectional area of (A) by the square of the cube root of displacement ratio, will provide an approximate value of the relative dimensions.

Cross sectional area of hull only $= 3\cdot7 \times \sqrt[3]{2\cdot8^2} = 7\cdot4$ sq. ft.
Length of hull ... ... $= 29\cdot5$ ft.
Drag (100 ft. per sec.) ... 9·5 lb.

The attitude of the stub floats to the water line is in this case assumed to be 4·2°, and their flying attitude of 2° is due to a negative angle of the hull when flying at maximum speed. Under these conditions the drag coefficient for the stubs is taken as 0·062, and their resistance is 7·3 lb.

Total drag of hull combination $= 16\cdot8$ lb.
Allowing 15 per cent. interference factor ... ... $= 19\cdot4$ lb.

It will be seen that the effects of normal requirements for flotation and stability are extremely disproportionate with this arrangement. The values given are necessarily subject to experimental verification, and some improvement might be looked for by more critical attention than has been necessary in a preliminary inquiry. Apart from this aspect the construction of a self-stabilising unit has much to commend its adoption.

Hull with Wing Floats. (C)

The attachment of auxiliary floats to the wings provides an excellent compromise in reducing the drag of flying boats to a minimum value. Hull design, and construction, is simplified, and performance on the water tends to be somewhat less critical than with stub floats. Presumably for these reasons, their use on general purpose machines is extensive. For high speed craft, however, certain objections particular to their special requirements must be considered. Of these, the location of small floats some distance below the planes involves using additional external members. To some extent, this may be offset by lowering the plane surface and reversing the strut bracing arrangement. This expedient introduces undesirable features regarding aerodynamic stability, and in consequence may seriously affect the flying qualities. Again, supposition is subject to experimental qualification. In the present instance the pros and cons of this aspect may be disregarded.

The displacement per wing float depends largely on their position relative to the hull. With opposite direction of air-screw rotation, the torque moment is relieved, provided, of course, both engines continue to operate. What reserve to fix in the event of either cutting out is debatable. In this instance the sectional area of each float is assumed to be 1·1 sq. ft., their total resistance 2·8 lb., increasing to 3·5 lb. to include fixing and interference.

Displacement ratio of hull to one float $= 3\cdot5$

Cross sectional area of hull $= 3\cdot7 \times \sqrt[3]{3\cdot5^2} = 8\cdot6$ sq. ft.

Resistance (100 ft. per sec.) $= 11$ lb.
Total drag for this arrangement 14·5 lb.

In arranging for two engines to be fitted, one advantage is that substantial improvement in speed may be obtained without recourse to more powerful engines. Research, a costly item, is thereby limited to construction of suitable types of marine aircraft. Increased experience of speeds upwards of 400 m.p.h. is directly available for aircraft development.

A brief reference to the possibilities of this or similar machines having two Rolls Royce engines of 4,000 h.p., representing one of the most formidable types of high-speed craft of the near future, may be of interest. Total weight has been roughly estimated to be 8,200 lb. It is desirable to limit the airscrew diameter so that the thrust centre is as close as practicable to the hull. As speeds advance it has been shown that blade diameters may be reduced without further loss in efficiency, although more than two blades are in consequence required. A four-bladed airscrew of 6·2 ft. diameter is assumed in the present case. Except that this machine is a good deal larger than a Napier-engined boat, the general construction remains much the same. Other particulars are :—

Main plane area	240 sq. ft.
Power/weight ratio	2·05 lb. per b.h.p.
Thrust h.p.	3,300.
Drag (with stub floats) ..	75·5 lb.
Maximum horizontal speed ..	425 m.p.h.

Assuming this figure to represent the highest speed attainable in level flight with this machine, a variation, increasing to as much as 5 per cent., may be obtained under the particular conditions associated with official speed attempts for record purposes. It is usual to enter the speed course after a fairly steep dive. Although a period is enforced in which to flatten out before passing the first mark, machines still retain considerable impetus due to this condition. This effect has been clearly demonstrated by dividing the measured course, and timing over the first and second halves. In a recent instance speeds so obtained averaged for six runs, 331·5 m.p.h. and 303 m.p.h. respectively. Causes other than diving no doubt affected these results. There is, however, reason to believe that true average speed is more likely to be established on the second half of the run than over the whole course under prevailing conditions. As such it should not be confused with official figures, which are concerned only with a method sanctioned by international agreement, and, of course, equally fair to all competitors.

In the speed given above, it has been shown that some 55 per cent. more power involves a corresponding increase in drag of 21 per cent., the speed improvement being round about 9 per cent., or 35 m.p.h. It is not proposed to stress the inference of these relative values, except to remark on the capabilities of a machine fitted with a new type of air-cooled engine. Although competing with water-cooled engines of much greater power and with aircraft of similar type, it has proved to be little if in any way inferior in performance. To what extent this demonstration will influence the evolution of racing craft, is not yet evident. It has served to show that for speed improvement, more powerful engines are not necessarily implied. It has also shown that at a later date, air-cooled engines may re-enter the field of endeavour for the special service of speed research.

In the foregoing remarks no more has been attempted than most briefly to consider the basic characteristics of the individual types mentioned for comparison. Always there is the fascination of more closely approaching the relatively unexplored regions of unknown but visualised phenomena, associated with speeds comparable to the velocity of sound. This period may be thought essentially critical, in as much as some indication of a limiting factor in performance may be unmistakable. Or, again, the conditions of air streams at these high velocities may be affected by other circumstances, and so defer the almost inevitable limitation in regard to ultimate development. Available evidence supports the former hypothesis. In constructing improved types of aircraft for experimental high-speed flying, data of fundamental importance may in consequence be established.

TECHNICAL FEATURES OF THE AIR MAIL.

By FRANK RADCLIFFE, B.Sc., A.R.Ae.S.

(*Continued from p.* 61.)

The United States of America, with a broad expanse of country, is now demonstrating that the air mail is a factor in everyday business, and the latest returns indicate that its popularity is steadily increasing and its extension a necessity.

It has just been stated that speed is of paramount importance and it follows, therefore, that night flying is another essential feature, if all handicaps are to be removed. The institution of night flying alone would improve present-day cruising speeds by 100 per cent., but not all of this would be realisable in an air mail service, as will be pointed out later.

Other features which will be contributory to accelerating a mail service will be : the lengthening of the effective range of the operating craft and the perfecting of means for "blind" flying and all that this implies. The experience derived from the recent Schneider Races indicates how higher speeds can be obtained and the design of military types for long-range has enabled another group of problems to be isolated. (The Fairey long-range monoplane has provided data for the air mail 'plane designer by giving a practical example of what can be achieved.) In the mail 'plane, therefore, we have an exceedingly interesting type to develop which will embody all the latest ideas of scientific research and demand the highest efficiency. To the writer it would appear to be a direct application of all the work that has been carried on during the past five years or so in specialised research and should provide a definite reply to the unsympathetic critic who queries the worth and need for such research.

The object of these notes, therefore, is to survey the problems confronting the desiger of air mail 'planes and of the operational difficulties to be surmounted if an efficient Empire air mail service is to be realised. It is intended, in what follows, that the remarks apply to a service operating for the transport of mails only, as apart from passengers, for it is believed that the two should be kept separate. This would be the soundest way of demonstrating the commercial value of the aeroplane.

Before looking at the possible routes which might be opened up, it will probably be useful if we discuss briefly the technical problems peculiar to an air mail service, the equipment required, both on the ground and in the aeroplanes themselves, and afterwards review the progress that has been achieved abroad. Finally, future possibilities can be investigated and lines of development indicated.

II. TECHNICAL PROBLEMS OF AN AIR MAIL SERVICE

(*a*) *Reliability and Speed.*—In order to qualify for contracts from the G.P.O., the efficiency of a new or alternative service must be as near 100 per cent. as is humanly possible and, further, it must offer real attractions over existing services in the way of accelerating the transport of mails. The payments for such a service are good and it follows quite rationally, that failure to achieve 100 per cent. efficiency will be heavily penalised. This is an important fact that should not be overlooked. For all practical purposes we can say that it is achieved in the older methods by land and sea. At present, in this country, mails are sent by the existing air services but their transport is not by contract and consequently there is no penalty clause to be met in the event of forced landings, etc. Reference to the 1929 Report on the progress of Civil Aviation (H.M.S.O.) indicates that, in the European service of Imperial Airways, of the number of scheduled flights, the percentage completed was 90·5, whilst of the actual flights commenced, 98·7 per cent. were completed. The latter figure is the one to note, and it is this which must be made 100 per cent. in order to make it attractive to the G.P.O. It will probably be conceded that 100 per cent. efficiency can never be achieved on flights alone, but what is important to note is that it *is* possible to arrange for such margins in a scheduled service so that 100 per cent. efficiency could be guaranteed for the delivery of mails, even though relief aircraft were needed to aid the original service. An example will probably make this clear.

Let us assume the following as data :—

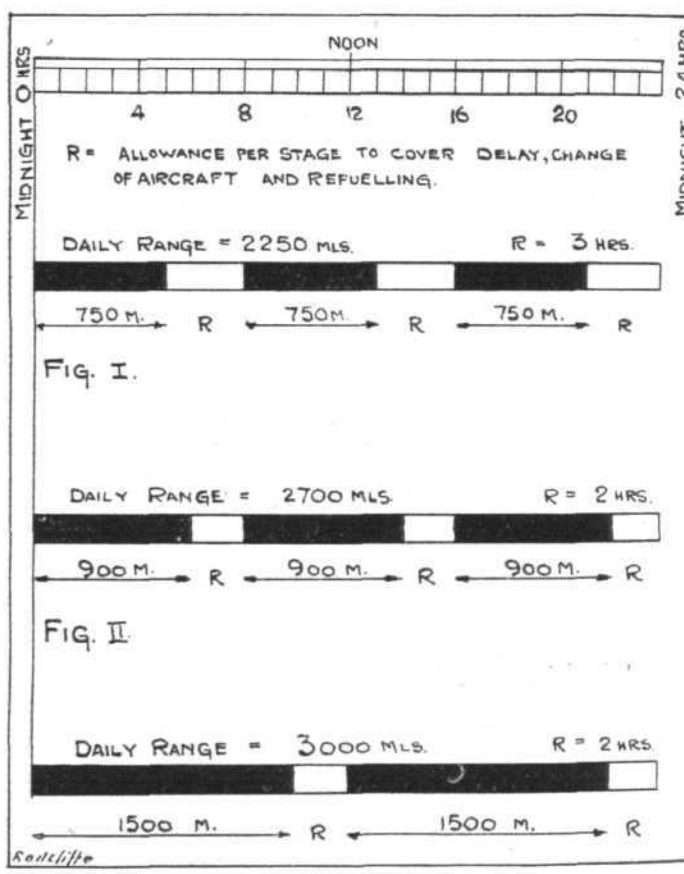
Cruising speed in still air = 150 m.p.h.

Range = 750 miles.

Number of stages per 24-hour day = 3.

∴ Total distance covered per 24-hour day = 2,250 miles.

In Fig. 1 is shown our 24-hour day divided into the three flying stages of 5 hours each, with a margin of 3 hours at the end of each stage to cover such contingencies as head winds, loss of speed due to failure of one engine unit, forced landing and changing of mails to relief aeroplane and changing the mails at the end of the stage to another aeroplane. The experience gained from the operation of the Cairo-Baghdad Air Mail should prove invaluable for checking whether such a time allowance is adequate. Two alternative schemes which could apply to favoured routes are indicated in Figs. II and III, and these give an increase in the daily range of 450 and 750 miles respectively, but the flying times are increased per stage from 5 hours to 6 and 10 hours respectively, and would necessitate the employment of two pilots, as the economic flying time for a pilot appears to be about 5 hours.



Schemes for 24-hour Air Service

It was mentioned previously that the institution of a night air service does not, in reality, double the average daily cruising speed and reference to Fig. 1 will indicate the reason. In this example the night service gives a 50 per cent. increase.

In the examples quoted above the cruising speed has been taken as 150 m.p.h. in still air. This value has been taken because if the cruising speed is increased much more than this amount the pay load becomes reduced to such an extent that the costs of operating the craft would become unremunerative. The company operating mail 'planes naturally wishes to carry as much pay load as possible, and as examples of what has been realised so far the following table will perhaps prove of interest (Table I). The figures have been collected from several sources and relate to commercial aircraft of various types. The disposable load (U) comprises the weight of the crew, fuel and oil, and pay load.

(*b*) *Type* (aircraft and engine).—The type of aircraft to be used for air mail transport will, of necessity, go through a period of development before finality is reached. Since

TABLE I

Aircraft.	$\overline{W}$ All-up Weight (Lb.)	W_E Weight Empty (Lb.)	$\overline{U}$ Disposable Load. (Lb.)	Number of Engines and total B.H.P.	$\frac{\overline{W}}{\text{B.H.P.}}$	$\frac{\overline{U}}{\text{B.H.P.}}$	Wing Loading. $\overline{W}/S$.	Range. Miles.	Vmax. M.p.h.	$\frac{\overline{U}}{\overline{W}}$.	Monoplane or Biplane.
Fairey Long Range	16,000	6,800	9,200	(1) 600	26·6	15·3	18·9	4,800	92	0·575	M.
Hawker Hart	4,320	2,496	1,824	(1) 570	7·6	3·19	12·4	600	184	0·42	B.
Farren Biplane	28,000	16,800	11,200	2,700	10·4	4·15	12·2		188	0·42	B.
Farren Monoplane	28,000	19,000	9,000	2,360	11·9	3·8	14·0		188	0·32	M.
A-W Argosy	19,200	12,090	7,110	(3) 1,188	16·2	6·0	10·25	600	110	0·37	B.
De H. Hercules	15,100	8,855	6,245	(3) 1,350	11·2	6·55	9·8		130	0·413	B.
B. & P. Sidestrand II	8,852	5,274	3,578	(2) 900	9·84	5·86	9·37		130	0·405	B.
B. & P. Sidestrand III	10,200	6,010	4,190	(2) 1,000	10·2	6·01	10·6		140	0·41	B.
Vickers Vellore I	9,500	4,771	4,729	(1) 490	19·4	9·75	6·7		110	0·5	B.
Vickers Vellore II	12,000	6,537	5,463	(2) 1,090	11·0	6·0	8·72		154	0·455	B.
Short Valetta	21,850	13,985	7,865	(3) 1,560	14·0	8·95	15·8	520	138	0·36	M.
Boeing 95 Mailplane	5,368	3,123	2,245	(1) 525	10·2	5·95	10·95		140	0·42	B.
Lockheed Sirius	5,200	2,780	2,420	(1) 425	12·2	5·7	19·62	720	175	0·465	M.
Fokker XIV	7,200	4,346	2,854	(1) 525	13·71	5·2	13·0		140	0·397	M.
Fokker F.32	22,500	14,200	8,300	(4) 2,300	9·78	3·95	16·67	480	140	0·37	M.
Caproni 90 P.B.	79,000	34,000	45,000	(6) 6,000	13·2	7·5	14·6	1,240	130–136	0·57	B.
Junkers G.38....	54,000	30,800	23,200	(4) 2,400	22·5	12·8	17·3		125	0·43	M.

the density of its useful load is greater than that for passenger work it can have a relatively small body and streamlining can be carried out to the fullest extent in order to get more speed. It is of interest, in passing, to record the fact that allowances for mail can be made at 16 lb. per cub. ft., whereas for passengers 5½ lb. per cub. ft. have to be allowed.

For some sections of the Empire air routes land 'planes will be necessary, whilst for other sections seaplanes (or flying boats) will be called for. The questions will arise of monoplane versus biplane, flying boat versus float seaplane, and one may rest assured that British conservatism will produce ardent supporters of all classes. The Vickers "Viastra" (1), two of which are for use by West Australian Airways, has been designed to have a cruising speed in the neighbourhood of 140 m.p.h. and should provide excellent data for development work. The Short "Valetta" (2), which can be used as landplane or twin-float seaplane, should also provide data on a big twin-float seaplane, the all-up weight of which is 22,400 lb. (its cruising speed is 105-110 m.p.h.).

The all-wing type, where the load is carried in the wings, will also make an appeal to designers in search of minimum parasitic drag and the writer feels safe in prophesying that in the next few years some very interesting and novel types of mail 'planes will be produced.

With recent reports published relating to the interference drag of various wing positions relative to the body, the high-wing monoplane should provide a strong attraction to designers for obtaining optimum body and wing combination.

In the previous section, a few notes were given on reliability as a factor to be considered in the design of mail 'planes, and this will raise for discussion the relative merits of single- and multi-engines for the power plant. In order to carry reasonably large mail loads it would appear that two engines, at least, will be necessary on account of the maximum available horsepower in present-day aero engines being approximately 500 h.p. Reference to Table I will prove useful as a guide, indicating what has been accomplished to date and what will be required both as regards the size of aircraft and the horsepower necessary.

The experience gained from the operation of the Cairo-Baghdad Air Mail indicates that the mechanical troubles with water-cooled engine installations were such as to make the air-cooled engine an absolute necessity (3). On the other hand, in order to achieve aerodynamic efficiency of a high order with an air-cooled engine, a cowling either of the Townend or N.A.C.A. type will be necessary. For either of these cowlings the ease of engine maintenance becomes seriously impaired unless great care is taken to make the cowling easily detachable in sections to give good accessibility. The difference in the efficiency of the water-cooled and of the air-cooled engines is certainly narrowed down from an aerodynamic point of view, by means of the air-cooled engine cowling. The air-cooled engine will give advantages over the water-cooled engine when the air-cooled Diesel engine becomes perfected and can be obtained in a form, say, similar to the new Halford-Napier H engine. Then we should have :—

(i) A reduced fuel consumption.
(ii) Absence of an electrical system.
(iii) Reduced fire risk.

(c) *Performance Requirements.*—The ideal mail 'plane will be one which combines the aerodynamic efficiency of the latest Schneider racers with the capacity for carrying a reasonable pay load per b.h.p. over a maximum range limited in time by the physical endurance of its crew.

The Schneider racers illustrate one extreme where load and range have been reduced to the minimum possible in order to obtain maximum speed. The Fairey long-range monoplane represents the other extreme, where speed is not the criterion but range. In this case pay load and speed are both relegated to a secondary place, whilst attention is focussed on getting the maximum load carried in the form of fuel. It can, of course, be pointed out for any aircraft that as the fuel load plus pay load is a constant, that if the fuel were reduced then additional pay load would be available for a shorter range, assuming that the volumetric capacity of the cabins was adequate.

A very useful paper having a bearing on the study of mail 'planes is afforded by the paper on "Monoplane *v.* Biplane,"

(1) *Vide* FLIGHT, June 27, 1930.
(2) *Vide* FLIGHT, July 25, 1930.

(3) "Cairo-Baghdad Air Mail"—Wing Cmdr. R. M. Hill, M.C., R.Ae.S. Journal, May, 1928.
(4) "Monoplane *v.* Biplane"—W. S. Farren, R.Ae.S. Journal, July, 1929.

by W. S. Farren (4), and in particular, the attention of the reader is drawn to Table V, which gives particulars of a hypothetical biplane and monoplane designed to cruise at 150 m.p.h. The table is reproduced in this article as Table II.

TABLE II

A Commercial Aeroplane to Cruise at 150 m.p.h.

Type	Biplane	Monoplane
Weight	28,000	28,000
Wing area S	2,300	2,000
Profile, R/W	0·025	0·025
Parasite, R/W	0·030	0·022
Induced R/W	0·030	0·034
Lb. per b.h.p., cruising	13·9	15·8
Lb. per b.h.p., max.	10·4	11·9
Span B	96·0	102·0
Chord C	12·0	19·5
	Percentage weights	
Power plant	24	21
Fuel and tanks	16	14
Wings	18	22
Rest of structure	18	21
Disposable	24	18
Crew and equipment	4	4
Passengers and luggage	16	14·4
Equipment	4	3·6
Horse-power/passenger	123	120

(W. S. FARREN)

The pay-load is of the order of 4,500 lb., which is bigger than contemplated for mail 'planes for use in the immediate future. The pay load per horsepower, in this case, works out at 1·67 lb. per h.p. for the biplane and the range would be of the order of 900 miles in still air.

A smaller type of aeroplane having a similar performance is the Hawker "Hart" (Table I), and we see here that there is a similarity in the characteristics of horsepower loading, wing loading and the ratio of disposable load to all-up weight.

(*To be continued.*)

VELOCITY TESTS ON FALLING BODIES RELATING TO PARACHUTING

By LESLIE L. IRVIN.

Mr. Leslie Irvin will be known to our readers as the inventor of the Irving Air Chute, which is the standard equipment of the R.A.F. In the following article Mr. Irvin gives certain information, not hitherto published, about the velocities attained by falling bodies. These velocities, it is found, are much lower than most people would have imagined. For example, a man falling freely reaches a terminal velocity of about 120 m.p.h. in 11 seconds.

As the parachute is now accepted by most airmen as a necessary addition to their flying equipment and the experience of jumping for life is common to several hundreds of men its technical problems expand in interest.

At least every military airman in Great Britain and America is compelled to know how to use one in an emergency, and from present signs we may expect this knowledge to be acquired by most civilian airmen in the near future. The number of private owners wearing parachutes increases, and as a civilian pilot who never flies without one I am glad to observe this growing habit whether the Irvin types hold the place of honour or not.

As a piece of flying equipment the modern parachute is fundamentally simple, but it has its technical problems, though they are not usually known amongst flying men. It is of immense importance to note that a reliable parachute depends for its success upon a 100 per cent. efficiency at all times, although it is invariably called upon to function at a second's notice.

When an airman is threatened with a crash and he decides to place his life at the mercy of his parachute it has to take full responsibility for his last chance of escaping death, and it must respond so quickly that no margin for temporary faults is available. To achieve this very high standard of reliability, research and experiment, though often of a trivial nature, must always be pursued. To-day it is acknowledged by impartial experts, at least those of the English-speaking world, that the manually-operated system of parachuting is a technical advance upon the automatic system which is still in vogue in several European countries. One of the major problems involved in the manually-operated system is the velocity of the man during his fall before the parachute opens. It is also a problem relating to the other system but not so importantly.

It is primarily peculiar to the manual system because this system allows the airman to fall as far as he chooses before pulling the rip-cord ring, an advantage which the automatic system does not give, as an automatic parachute always opens when the length of the static line has been reached, irrespective whether the position of the falling airman in relation to the abandoned aircraft is safe or not. Now until comparatively recent tests were made data casting light upon the rate of fall, acceleration and physical effect of long drops was vague and indefinite. As a consequence many illusions were held, one being that the acceleration was so terrific after a long fall that the parachute would burst or the man would lose consciousness. For the sake of airmen who were liable to resort to the parachute at any time it was necessary that these false impressions should be cleared away, because it was an accepted fact that in many situations a long delayed drop before pulling the ring seemed safer, owing, possibly, to the machine falling in the airman's path, and other causes.

Before commencing these important tests the experts were already familiar, of course, with the common scientific fact that, ignoring air resistance, objects fell with uniformly increasing velocity irrespective of their weight, size and shape, but that as air resistance could not be discounted in the case of a falling man his weight, size and shape had to be considered.

It was known that the rate of fall accelerated and his resistance increased in proportion to the square of his speed until it equalled his weight, when acceleration ceased, in other words, terminal velocity was attained.

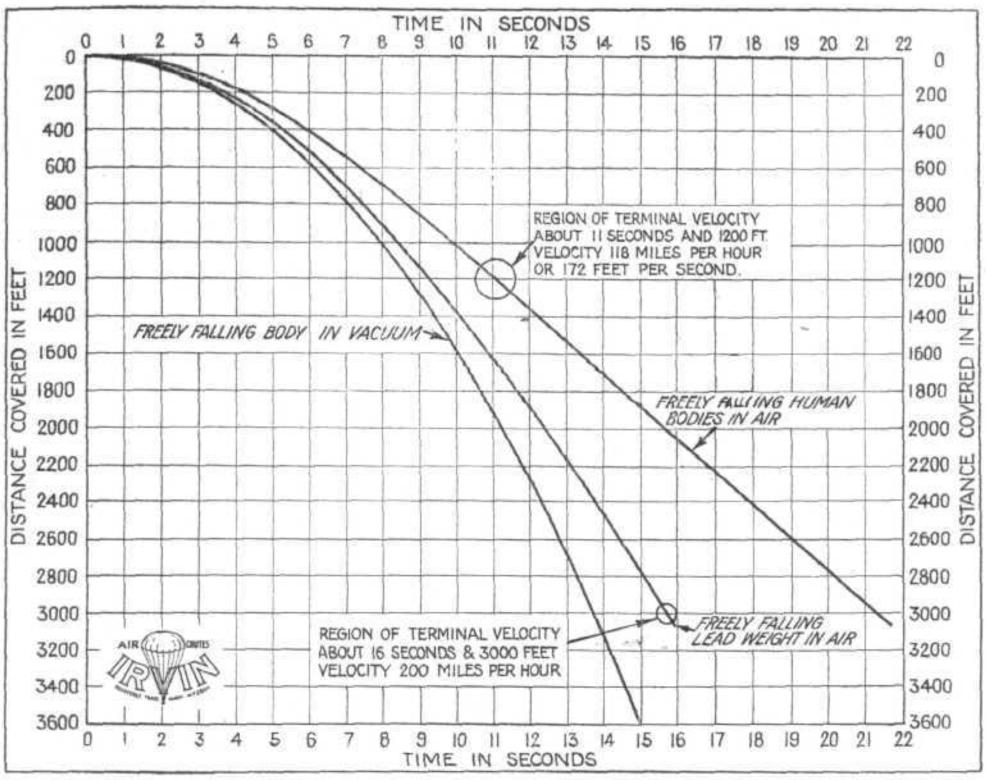
It was found necessary to make the tests at night with the aid of photography. A camera shutter was so adjusted that it remained open except when shut at second intervals, and on the plate a scale of vertical distances was added. The aeroplane flew as accurately as possible on a course parallel to the horizontal axis of the camera installed on the ground.

A dummy weighing 180 lb. of the size of a man with a dummy parachute pack on its pack, was dropped from the cockpit with a blazing flare attached to it, and as it fell the camera recorded a series of dashes as the shutter opened and closed, each dash being a length proportionate to the distance fallen at second intervals.

With the scale of distances and the series of dashes on the photograph as data, it was easy to plot a curve and determine the velocities.

Results proved that far from a man reaching unbearable speeds he reached his terminal velocity at 175 ft. per second (119 m.p.h.) in 11 sec. after falling 1,200 ft. A series of similar tests with the same dummy showed that the figure only varied when the dummy oscillated, which then reduced the terminal velocity to a minimum of 160 ft./sec.

Very little oscillation occurred when 175 ft./sec. was recorded, which shows that as the human figure has a greater tendency to oscillate—before the parachute opens—than a



By courtesy of Irving Air Chute, of Great Britain, Ltd.

dummy its terminal velocity may be accepted as lower than 119 m.p.h.

Further tests bearing upon the effect of weight, size and shape factors showed that a dummy weighing 115 lb., but of the size and shape of the 180-lb. dummy, reached its terminal velocity at 85 m.p.h. in 10 sec.

The slower rate of fall was apparent even to eye witnesses on the ground. When a 200-lb. lead weight of cubical form with parachute pack attached was dropped as a test similar to that imposed by military experts in England and America upon all Irvin types, it was found to reach 200 m.p.h. in 15 sec. from an altitude of 3,000 ft.

The curve drawn indicated that terminal velocity had nearly been reached as the weight hit the ground.

Incidentally, this high velocity extinguished the flares on the dummy and electric lamps had to be used.

A common fact confirmed by these tests was that in the case of a falling body an increase in weight or a decrease in projected area produces an increase in maximum velocity.

Now although it is proved that 175 ft./sec. (or 119 m.p.h.) is the airman's falling velocity, we must not assume that the maximum shock load imposed upon a parachute is determined by that figure, or that it represents the highest speed at which the parachutist can move. These matters are determined by the speed of the aircraft. If a machine travels more than 119 m.p.h., as most military aircraft do, the designer must not base his calculations upon 119 m.p.h. because the moment the airman leaves his machine he travels at the same rate as the machine, and if this is above 119 m.p.h. and he opens the parachute immediately it will have to bear a higher shock load. And the variation applies when the machine travels less than man's terminal velocity.

Thus the designer must disregard the terminal velocity in preference for the top speeds of aircraft, but it is important for the parachutist to be familiar with rates of human acceleration and terminal velocity because with a manually-operated parachute he controls the distance he falls and therefore to a degree the shock load. It is preferable in extreme cases that he should try to protect his parachute from excessive loads, as for instance when he jumps from a machine in a terrific dive, though the designer does not depend upon his assistance, of course, when determining the strength factors of his parachutes.

The horizontal velocity rapidly decreases as the vertical velocity increases, and if the airman waits until he has reached terminal velocity after a swift dive he will still meet less shock load than if he opens the parachute immediately.

When jumping from a machine travelling less than 119 m.p.h. he should not delay the opening unless, of course, it is safer to do so for other reasons.

Most airmen who are open to the possibility of jumping for life are mainly interested in the lowest altitude for a safe leap. The problem naturally depends upon the position and direction of the aircraft. Irvin air chutes open in $1\frac{3}{5}$ sec., a time that may be taken as an average. If the horizontal speed of the machine is very high the chute will open more rapidly than if the machine is at stalling speed the moment the jump takes place, and the high speed will check the airman's downward travel. But a diving machine will impart a downward velocity to him, so bringing him closer to earth before the parachute opens. In a spin it will probably be safer to delay pulling the ring to avoid the canopy ballooning into the tail unit. Thus these considerations make it difficult to establish a safe minimum altitude for jumping.

One member of the Caterpillar Club escaped at 150 ft. If we assume that he fell a second before pulling the ring and add $1\frac{3}{5}$ sec. for the opening of the chute we see from the curve on our graph that he fell at least 100 ft. before his fall was checked, leaving only 50 ft. to swing him to safety.

Several pilots have leaped safely from stricken 'planes at 200 ft. They have invariably risked the danger of a premature opening, a danger that is not really to be feared unless the machine is flying slowly and perhaps dropped down to stalling speed.

As a concluding item concerning the velocity tests described, it was of interest to learn that English and American experts experimented independently and reached identical results.

COMPARISON OF AIRCRAFT.

Some Criticisms of Capt. Sumner's Article.

By W. Bailey Oswald.

Mr. Oswald, who is Teaching Fellow at the Guggenheim School of Aeronautics of the California Institute of Technology, Pasadena, California, U.S.A., sends us the following article.

I noticed with considerable interest an article by Captain P. H. Sumner in the Aircraft Engineer, July 25, 1930, which was titled "Comparison of Aircraft." The subject is one which is certainly worthy of investigation, and much comment, for by comparison of aircraft we are urged to discard poor designs in favour of those of proven value. A comparison of aircraft has a distinct and primary position in the general aeronautical development of the age.

It is only proper, therefore, that we use great care in the selection of suitable values of comparison, which may truly be regarded as figures of merit for the aeroplane considered. The writer has studied the ratio values proposed by Captain Sumner, both from the theoretical relations involved and from the tables of ratio values for aircraft presented in the article in question, and feels that the comparison that is afforded by the use of the ratio values is not justified. The considerations that lead to this conclusion will be briefly stated in the paragraphs to follow.

Only the characteristics of aeroplane performance which have been considered in the article in question will be considered here. These are by no means all the characteristics which should be compared, but may be regarded as three of major importance.

Maximum Velocity.—For comparison of aircraft of similar type, the effect of induced drag upon maximum velocity may be neglected, and the maximum velocity, V_m, is approximately represented by,

$$\text{(1)} \qquad V_m = A\left(\frac{BHP_m \cdot \eta_m}{f}\right)^{\frac{1}{3}}$$

where A = a constant
BHP_m = brake horse-power at V_m
η_m = propulsive efficiency at V_m
f = equivalent flat plate area of resistance.

Thus, a figure of merit (or comparison) may well be taken as,

$$\text{(2)} \qquad M_v = \frac{V_m}{BHP_m^{\frac{1}{3}}} = A\left(\frac{\eta_m}{f}\right)^{\frac{1}{3}}$$

The speed ratio as compared to M_v is,

$$\text{(3)} \qquad \frac{V_m}{BHP_m} = M_v \frac{1}{BHP_m^{\frac{2}{3}}}$$

The speed ratio value, therefore, contains $\frac{1}{BHP_m^{\frac{2}{3}}}$ times a reasonable figure of comparison. This is beautifully illustrated in the tables by the fact that substantially all the low-powered planes in any group have high speed ratio values, and conversely for high-powered planes. One must pay with horse-power for maximum velocity in proportion to the *cube* of the velocity, and *not directly* with the velocity as the speed ratio value would indicate. Thus, one may expect to realise a change in maximum velocity in proportion to the one-third power of the brake horse-power. The speed ratio value is worthless for the comparison of even similar type aeroplanes as is evidenced in the tables.

Maximum Rate of Climb at Sea Level.—It may be shown that for similar type aeroplanes (*i.e.*, aeroplanes with absolute ceilings of the same order), the maximum rate of climb at sea level is represented to within several per cent. by

$$\text{(4)} \qquad C_o = B\,\frac{BHP_m^{\,r} \cdot \eta_m^{\,r}}{W^s}$$

where: B = a constant for any one type aircraft.
W = gross weight
r and s = exponents depending mainly upon type of aircraft.

And if it is desired to compare performance to horsepower, we obtain as a figure of merit,

$$\text{(5)} \qquad M_c = \frac{C_o}{BHP_m^{\,r}} = B\,\frac{\eta_m^{\,r}}{W^s}$$

Type Aircraft.	r	s
Pursuit	1·25	1·4
Observation	1·4	1·6
Light bombardment	1·45	1·7
Training and heavy bombardment ..	1·5	1·8
Heavy seaplanes	1·8	2·2

The proper values of r, s, and B vary *continuously* from one type of aircraft to the other (*i.e.*, they vary continuously with the absolute ceiling of the aeroplane with unsupercharged motor). However, the variation for any one type of aircraft is small, and a constant value of each r, s, and B may well be assumed for comparisons between aircraft of similar type. It must be remembered that this assumption no longer is valid when the absolute ceilings of the aeroplanes being compared differ greatly.

The climb ratio as compared to M_c is,

$$\text{(6)} \qquad \frac{C_o}{BHP} = M_c \cdot BHP_m^{\,r-1}$$

The climb ratio value is seen to contain $BHP_m^{\,r-1}$ times a factor which is believed to afford a reasonable comparison of aircraft. $r - 1$ is greater than zero, being of the order of 0·5. Therefore, the climb ratio value definitely favours the aeroplane with the greater horsepower. The climb ratio value is thus misleading as a figure of merit for the maximum rate of climb of aircraft.

Useful Load.—Since the comparison of aeroplanes has been made with the B.H.P.$_m$, it is fair only to consider the useful load flying at or near the maximum velocity. At the attitude of the aeroplane for maximum range the characteristics of the aeroplane, span, equivalent flat plate area, and weight, predominate, and not the B.H.P.$_m$. However important the latter case of maximum range, it will not be considered here, since it is chosen to make the comparison to B.H.P.$_m$ in the article in question.

The speed at which the load is transported must be taken into consideration. From equation (1) it is seen that for the same aeroplane :—

$$\text{(7)} \qquad BHP_m \cdot \eta_m = D\,V^3$$

where D = a constant.

Thus we may expect to pay with horsepower for the transportation of a definite useful load in proportion to the *cube of the velocity at which the load is transported.* Any comparison of useful load to horsepower without taking the velocity into consideration is valueless and misleading. Nor is it justifiable to omit the maximum rate of climb at sea level, since some aeroplanes carry their load with considerable climbability and ease, while others are hardly able to take-off, being loaded to the limit. The antiquated type of plane will thus have the high useful load ratio value, and the modern, high-speed transport with a generous reserve of power will have the low useful load ratio value. It is easily seen from the tables that the slowest, least manœuvrable, oldest, and generally most useless aeroplanes have the higher useful load ratios.

Perhaps even absolute ceiling and range should be considered ; however, it will be assumed that aeroplanes of similar type have comparable values for absolute ceiling and range and the comparison is made between aeroplanes of similar type.

A figure of merit might be suggested as,

$$\text{(8)} \qquad M_L = \frac{W_u}{BHP_m}\,V_m^{\,3} C_o^{\frac{1}{r}}$$

where W_u = useful load.
and substituting equation (5) in equation (8), and assuming η_m constant, M_L is approximately represented by,

$$\text{(9)} \qquad M_L = E\,\frac{W_u}{W^{s/r}}\,V_m^{\,3}$$

where E = a constant for any one type aircraft.

Such a figure of merit as M_L gives credit for performance and good engineering, neither of which may be overlooked.

Conclusion.—The ratio values are generally concluded to be worthless and misleading. In their places are suggested :—

For maximum velocity, $M_v = \dfrac{V}{BHP_m^{\frac{1}{3}}} \propto \left(\dfrac{\eta_m}{f}\right)^{\frac{1}{3}} \propto \dfrac{1}{f^{\frac{1}{3}}}$ (approx.)

For maximum rate of climb, at sea level,

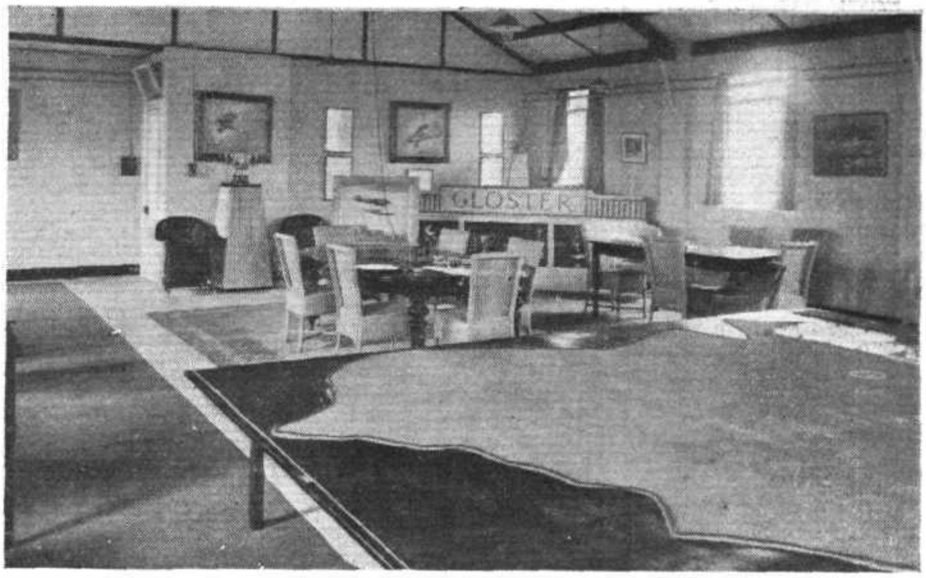
$$M_c = \frac{C_o}{BHP_m^{\,r}} \propto \frac{\eta_m^{\,r}}{W^s} \propto \frac{1}{W^s} \text{ (approx.)}$$

For useful load, $M_L = \dfrac{W_u}{BHP_m}\,V_m^{\,3} C_o^{\frac{1}{r}} \propto \dfrac{W_u}{W^{s/r}}\,V_m^{\,3}$ (approx.).

The above comments and suggestions are probably open to further comment and criticism. The attempt has merely been made to lay on the table the facts and proper proportions at hand, and therefrom deduce reasonable "Figures of Merit and Comparison for Aircraft."

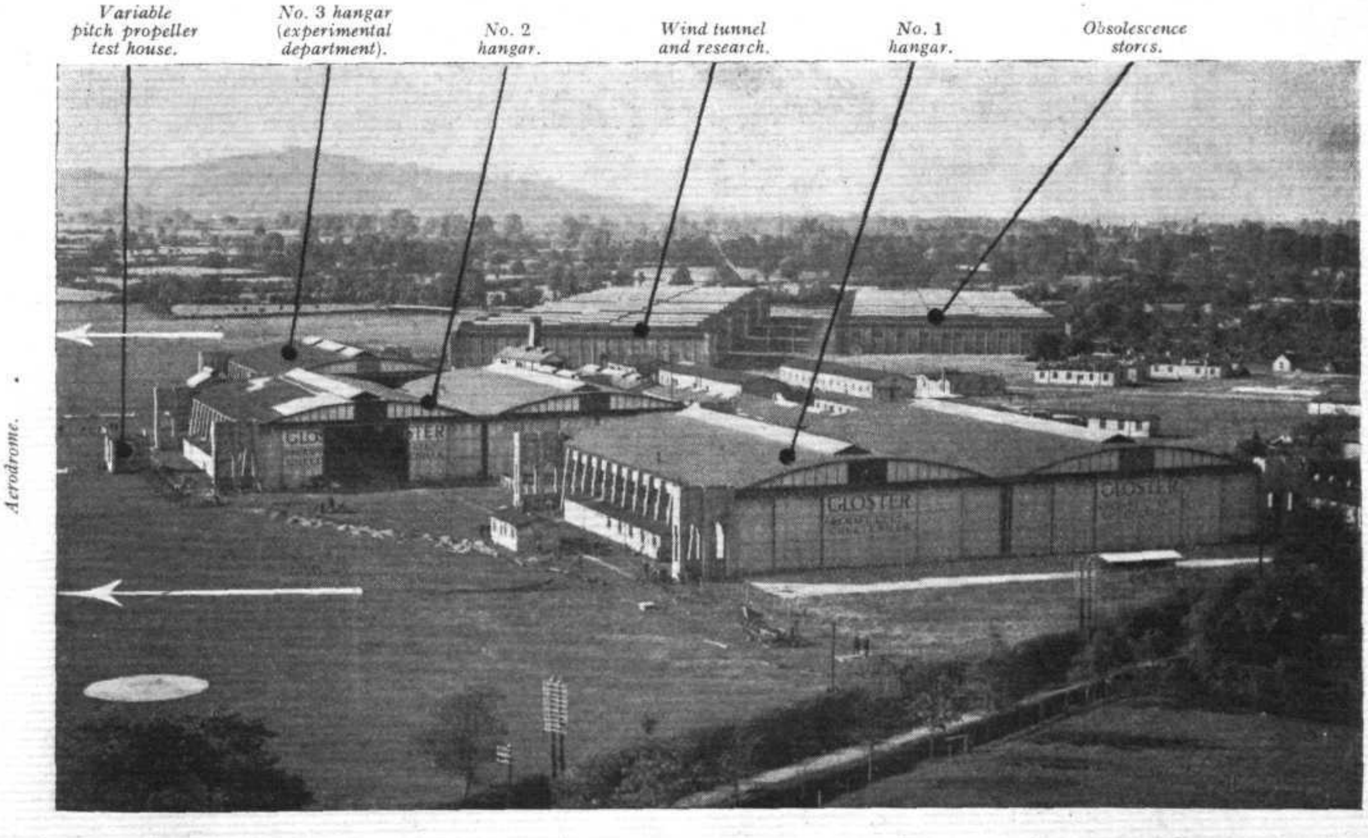
It would be of interest to have the proper authority, or authorities, present a table giving the weighted value of each Figure of Merit in any one type of aircraft. Thus, by combining in a product each Figure of Merit to its proper proportion, one general overall Figure of Merit for the aeroplane in question could be obtained. It is realized, of course, that the above figures are not the only ones that need be considered. Such a general comparison of aircraft should be very interesting and illuminating.

NEW GLOSTER WORKS AT BROCKWORTH



A Corner of the very beautiful Board Room. In the foreground may be seen portion of a large-scale model of Brockworth Aerodrome, the Gloster Works, etc. (Flight *Photo.*)

PROBABLY an industry has rarely been faced with such a series of problems as those which arose out of the decision of the British Air Ministry some years ago to insist that, after a few years of grace, all aircraft designed for service use were to be built entirely of metal, with exception of covering. At the time a few of the British aircraft firms had foreseen that the demand for all-metal construction was bound to come sooner or later, and had already begun seriously to tackle the problems. Perhaps three or four firms had evolved forms of metal construction which gave good results, and which would at least provide a basis upon which to build in the future. Generally speaking, however, the firms in the British aircraft industry had had but very little experience of all-metal construction, and there were not a few which had none at all. It may readily be imagined that the problems with which such firms were faced were very serious indeed. Not only were the engineers and designers of the firms confronted with the task of evolving types of construction which were structurally efficient and of reasonable cost in manufacture, but the vast majority of workers had been trained and engaged as woodworkers. Consequently, the change-over to all-metal construction either meant a gradual discharging of all these people, substituting for them metal workers who, although skilled in some particular trade or other, were by no means skilled in the sort of metal work which had to be undertaken. In fact, except for their general training as metal workers, they knew nothing of aircraft metal work, because previously there had been no all-metal work outside the very few firms referred to above. Or, as an alternative, firms could gradually train their woodworkers to become metal workers as far as all-metal construction of aircraft was concerned. In either case the negotiations with the various trade unions concerned were somewhat delicate matters, as can readily be imagined. Some of the aircraft firms chose one method, some the other, and a fairly general procedure was to combine both by training a certain number of woodworkers and engaging a certain number of metal workers from outside industries. The problems, technical as well as industrial, were often extremely difficult, and it speaks volumes not only for the ingenuity of the aircraft firms' staffs, but for the workers as well, that by now every



NEW GLOSTER WORKS AT BROCKWORTH: An aerial view showing most of the main buildings. (Flight *Photo.*)

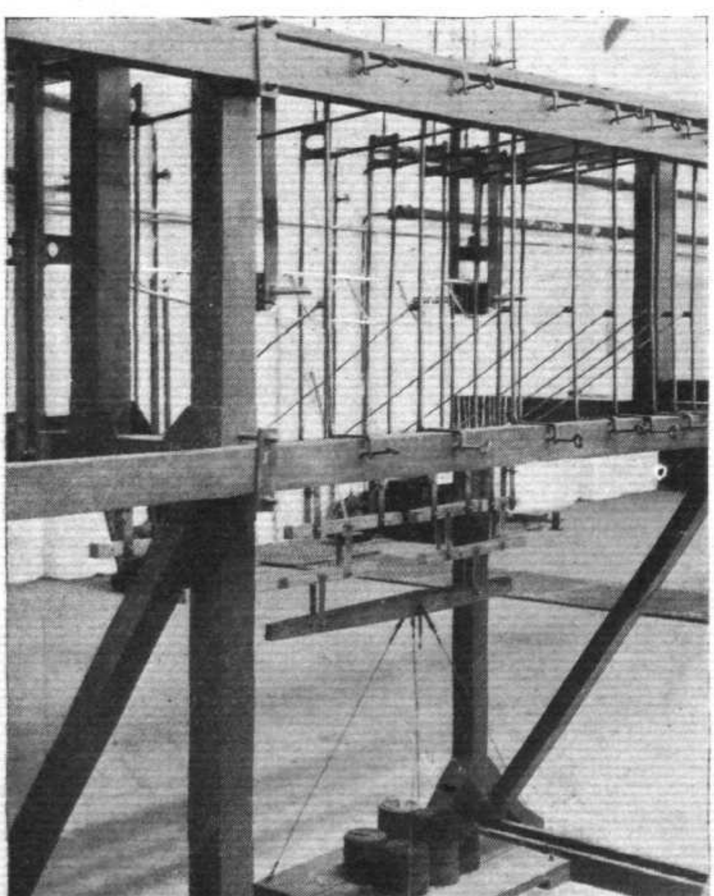
A CORNER OF THE GLOSTER DRAWING OFFICE: This important section of the works is situated very centrally, and adjoins the experimental shop. (FLIGHT *Photo*.)

British aircraft firm which supplies machines to the Air Ministry for service in the Royal Air Force has evolved and "stabilised" (one can scarcely say standardised as yet, since the process of evolution is still going on) forms of metal construction which are at least up to the standard of anything produced abroad, and in most cases very far ahead of foreign practice.

Apart from the difficulties connected with the evolution of *forms* of all-metal construction, the aircraft industry had to re-equip its workshops with new plant suitable for the production, in large or small quantities as the demands of the moment required, of all-metal aircraft. Woodworking machinery had to be disposed of, and new types of machines had to be purchased instead. Not only so, but the manufacture of metal components, usually from metal strip, either steel or Duralumin, in many cases necessitated the design of entirely new types of machines, the manufacture of metal aircraft calling for structure members of a form not used in any other industry, and for which, therefore, no machines existed. One might go on at length indicating the multitudinous problems and difficulties which had to be overcome, and it is doubtful whether even now it is generally realised how difficult a time the British aircraft industry has had during the last three or four years. However, it will probably be of greater interest to our readers if we take as an example an actual firm and show the manner in which that firm has tackled the task of changing over to metal construction. For this we have chosen the Gloster Aircraft Company, partly because it is typical of the evolution which has taken place throughout the industry, and partly on account of the fact that as now organised the new Gloster works are among the best-planned and best-equipped in the country, having been planned specifically with all-metal construction in view and not converted from shops originally laid out for the building of wooden machines.

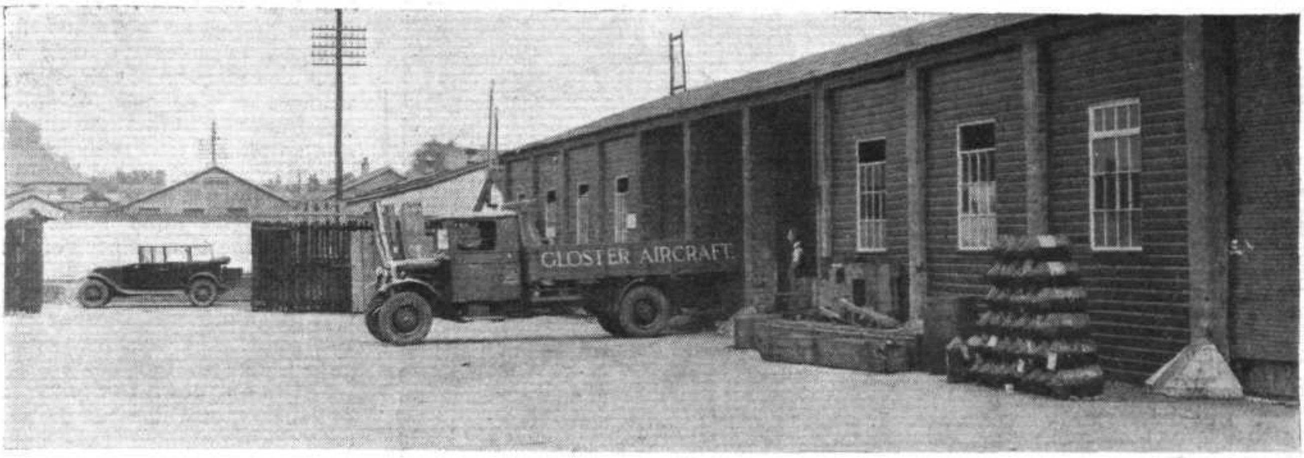
When the Gloster Aircraft Co. purchased from the Government, in 1923, the aerodrome and large hangars at Brockworth, on the road from Gloucester to Cirencester, and near the interception of that road and the road running from Cheltenham to Stroud, there were those who, failing to appreciate the foresight and acumen of Mr. David Longden, thought the Gloster Company had saddled itself with something of a "white elephant." The firm had to have an aerodrome, to be sure, no land being available near the Sunningend works of the company, but an aerodrome with large hangars, &c., was surely burdening oneself with overhead charges that might easily become unbearable. Thus, many critics. What these critics did not take into account was that Mr. Longden was taking a very long view and foresaw that considerable changes were bound to come about, changes which would be likely to make of Brockworth an almost ideal site for an aircraft factory and works. The Air Ministry's decision to change over to all-metal construction had not then been made, but the Gloster Company had already started to experiment, in quite a small way it is true, with the production of aircraft structure members of metal in place of wood, and some interesting types of spars, fuselage members, &c., were produced.

Then, in 1927, when there was a definite assurance that all-metal construction would be universal in a few years' time, the Gloster Aircraft Company again showed great



A wing rib under test. (FLIGHT *Photo*.)

"A Stitch in Time": Girls at work on wing fabric. (FLIGHT *Photo*.)



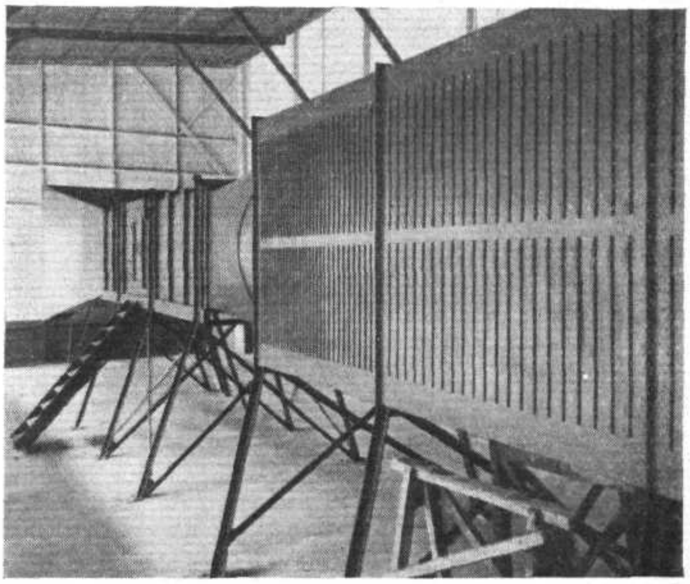
The Main Artery: The Receiving and Despatching Departments are next to each other, and close to the main gate, so that trucks leaving and arriving are under the eye of the gatekeeper. (FLIGHT *Photo.*)

foresight in absorbing the Steel Wing Company, a firm owned by Mr. J. D. Mooney, and which had been engaged exclusively on steel construction since 1915. By taking over that firm and its technical staff, the Gloster Aircraft Company acquired the accumulated experience of many years and saved itself a very great deal of experimental development work.

When transferring the Steel Wing Company's plant and staff to Gloucestershire from London, Brockworth and not Cheltenham was the place where the plant was installed. This was all part of the future plans of the company, Mr. Longden having decided that if his company was to hold its own in the keen competition of the future it was essential to start with works properly laid out for quantity production.

The plant of the Steel Wing Company having been installed at Brockworth, work was undertaken at once, and large quantities of steel wings were produced, largely for Westland "Wapiti" machines. To give an idea of the magnitude of the production, it may be stated that in 1929 something like 250 sets of steel wings were produced, while it seems likely that the production for 1930 will exceed that figure.

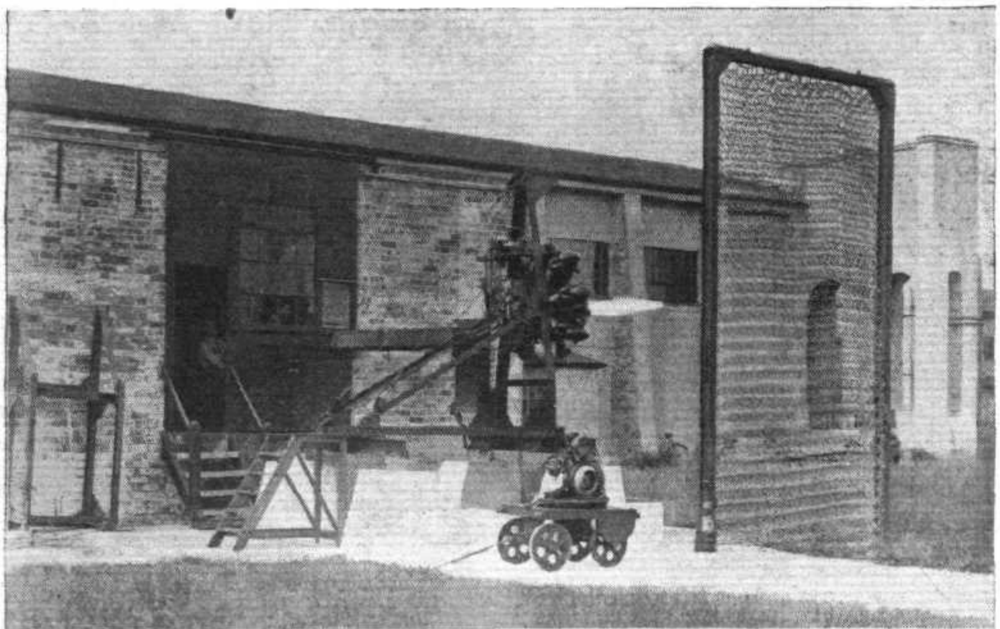
In the meantime, the old works at Sunningend, Cheltenham, continued with such production as was then in hand, and the famous Schneider Trophy machines, among others, were built mainly there. But gradually one section after another was transferred from Sunningend to Brockworth until at the present time the transfer is complete and the Brockworth factory is in full working order. The general offices, drawing office, &c., are now also situated at Brockworth, and the only works which remain at Sunningend is the tinsmith shop, which has been turned into a separate factory for doing motor-car coachwork, &c., but which will also in the future attend to the production in quantity of aircraft tanks.

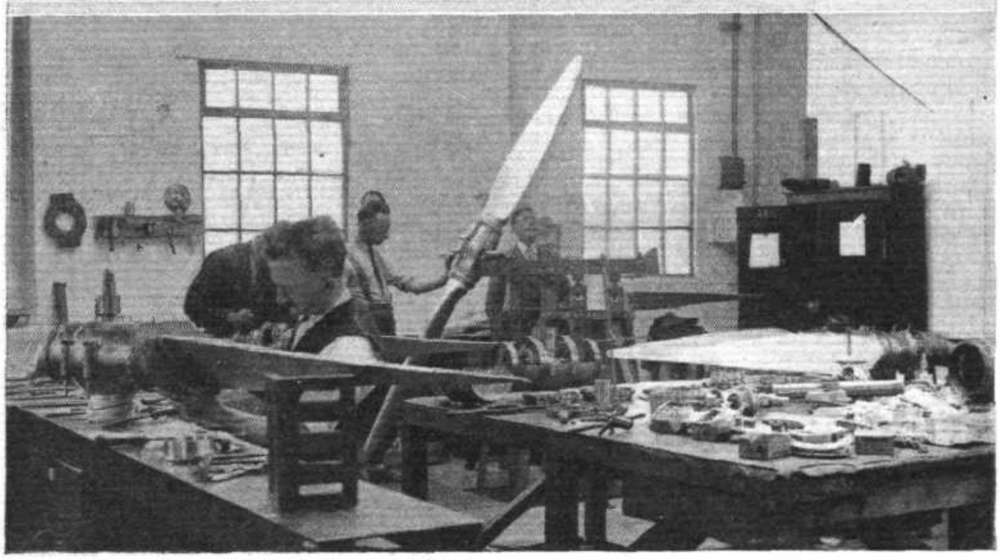


A recent addition to the equipment: The wind tunnel of the Gloster Company is one of the latest aids to design. (FLIGHT *Photo.*)

In planning the new works at Brockworth, Mr. Longden played a very important part, for although he naturally consulted those members of his staff concerned, he undertook personally to plan the lay-out. In a general way it may be said that the Brockworth works, while making full use of the buildings which already existed, have been so planned that the raw material enters on one side and the finished aircraft is flown off the aerodrome at the other. Not only so, but during the process of manufacture it is almost literally true to say that no component ever traverses the same ground twice. Waste of time and labour has been eliminated as far as possible. Almost for the first time in the history of British aviation one has here a

ALL-STEEL WINGS IN COURSE OF CONSTRUCTION: Draw benches as well as rolling mills are employed. (FLIGHT *Photo.*)





VARIABLE-PITCH AIRSCREWS: Below is seen a corner of the shop devoted to the production of the Gloster-Hele Shaw-Beacham variable-pitch all-metal propellers. Above is shown the special testing plant for variable-pitch propellers. (FLIGHT *Photo.*)

along an approach. To the right, before the gates are reached, are garages, cycle sheds, &c., where staff and employees can leave such vehicles as they use for going to and from the works. By the gates, and so placed that the gate keeper can view the whole approach from his window, is the gate keeper's lodge. The same building also contains the timekeeper's office, the telephone exchange and waiting rooms for callers. After passing this lodge one sees another gate on the right. At the moment this gate is closed, but behind it is a road running down to two long rows of hangars, of which but the first in each row is occupied at the moment, but which are available for expansion as soon as the volume of work in hand requires it.

Passing on to another gate straight ahead, one is at last in the works grounds proper. The first building contains, near the gates, the buyers' department and raw materials stores, while the receiving and despatch departments are in another building immediately opposite. Thus, raw materials are required to travel the shortest possible distance after passing the gates.

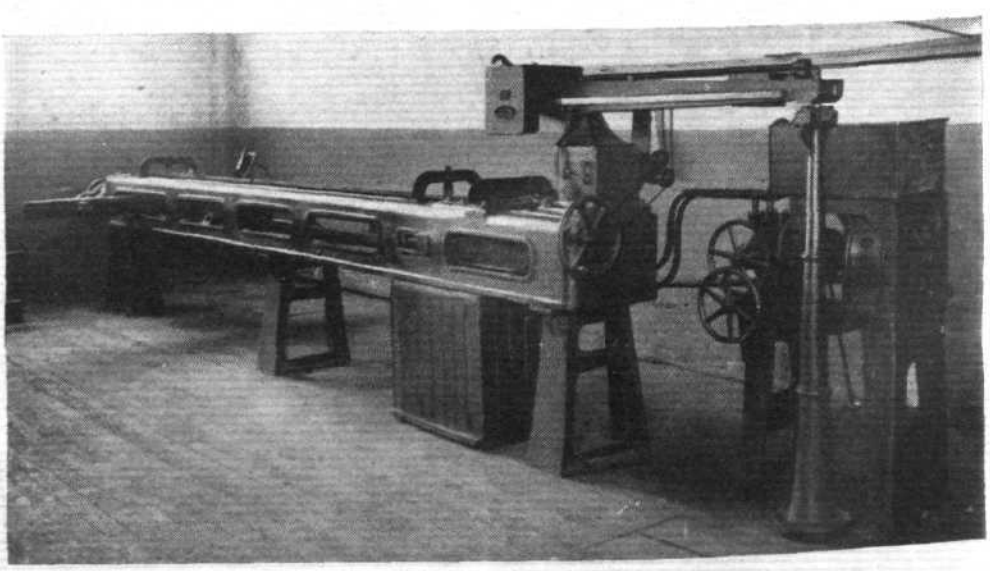
If one turns left after passing the second gate, one sees on one's left in turn the department devoted to the development of the variable pitch airscrews, the canteen, and the general administrative offices. On the opposite side one has a long low building in which are housed the sheet-metal shop, the covering shop and the dope shop.

The largest buildings at Brockworth are the three hangars numbered 1, 2 and 3. No. 1 is nearest to the Gloucester road, while No. 3 is farthest away from it. In No. 1 hangar are the rolling mills and draw benches used in forming steel strip into sections, and here also are the vertical jigs used in assembling the wings. No. 2 hangar is, like No. 1, a double-span one, and the half nearest the aerodrome is used as a flight test shed and for final erecting. The other half contains the enamelling plant, and in this also is carried out the finishing of the wings, *i.e.*, such operations as have to be carried out *after* enamelling. From the final wing finishing

factory which was designed from the beginning for the work to be undertaken. What this will mean to the future rapid production of aircraft can readily be imagined.

Situated in delightful surroundings among the hills in the Gloucester-Cheltenham district, Brockworth should prove attractive to aircraft workers who have any regard for the advantages of working and living in healthy surroundings. The distance from Cheltenham and Gloucester is but short, and a tram line from the latter town already runs to within a short distance of the works' gates. And houses are being built even nearer to the works, so that the housing and transport problems connected with any large industrial undertaking should be relatively simple in the case of Brockworth.

The aerial view of the Brockworth works, published on page 1069, shows all the main buildings, although many of the smaller ones are hidden in the background. To enable readers the more readily to follow us through a tour of inspection of the works, we have indicated on this photograph some of the main "landmarks." Upon turning off the main road one proceeds towards the main and only gates of the works



FOR TESTING TENSILE STRENGTH: A 10-ton Dennison machine. (FLIGHT *Photo.*)

shed the wings pass to the covering shop already referred to, and thence to the dope shop, ultimately to return to No. 2 hangar for erecting on the fuselages.

Adjoining No. 1 hangar is a newly-built house in which the plant for heat treatment is housed. This plant is intended to deal with quantity production only, and not with experimental work, the latter being done in No. 3 hangar, which contains the experimental shop.

No. 3 hangar is, perhaps, that part of the Brockworth works most interesting to the visitor. It is laid out as a self-sufficient works on a small scale, and contains rolling mills, draw benches, machine and fitting shops, experimental heat treatment plant and so forth. In fact, No. 3 hangar is self-contained, and is able to carry out all experimental work without interfering with the quantity production plant in No. 1 hangar at all. In a corner of the experimental works is a plant for Anodic and Cadmium, etc., treatment. This plant, however, serves not only the experimental department but the whole works.

Adjoining the experimental shop are the offices of the chief engineer, assistant chief engineer, the R.T.O. and A.I.D., and the works manager. This building also houses the general drawing office, tracers' office, drawings-files and blueprint department.

Reference has previously been made to two long rows of sheds on the western side, two of which are at present occupied. The first of these, in the south row, contains the new wind tunnel which the Gloster Company has recently had installed. This tunnel will shortly be in full working order, and should materially assist the designers in their work. In the same building are also housed the general research office and the department dealing with structural experimental work and testing. This building is situated quite close to the designing and drawing offices and to the experimental works in No. 3 hangar.

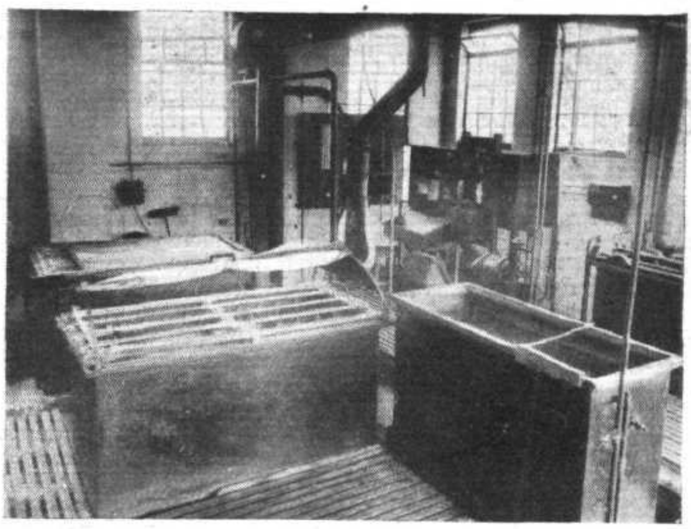
The first building of the second row of hangars at present houses such stores as include spares for obsolescent machines, spares not frequently wanted, but for machines which, although still being used by a few squadrons, are gradually going out of service.

On the aerodrome side of No. 2 hangar is an engine test plant largely used for test work in connection with the development of the Gloster-Hele Shaw-Beacham variable pitch propeller. One of our photographs shows a Bristol "Jupiter" with variable pitch propeller on the test bed.

The electric power house is placed almost in the centre of the works so that the length of the electric leads is kept down to a minimum. Close to the power house is the boiler house, in which is generated the steam for heating the shops.

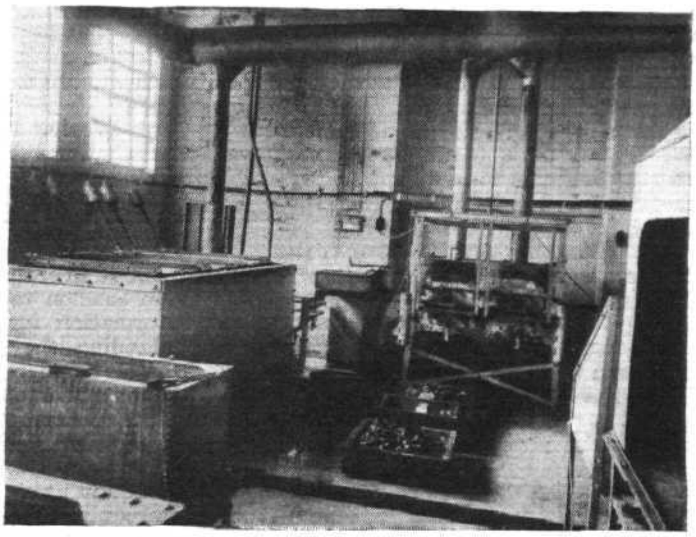
The floor space of the new Brockworth works is in the neighbourhood of 405,700 sq. ft., and the aerodrome on which the works are built has an area of 150 acres.

Apart from its very obvious immediate suitability and capacity for quantity production of aircraft, Brockworth may well in the not too distant future become the recognised aerodrome for the cities of Cheltenham and Gloucester. Ample hangar accommodation is already available, and facilities for repairs, &c., while doubtless, if the aerodrome became recognised as the official one for this part of the west, manufacturers of light aeroplanes would arrange for spares to be stored there so that visitors by air could obtain from stores any spare part likely to be needed for their machine or engine.



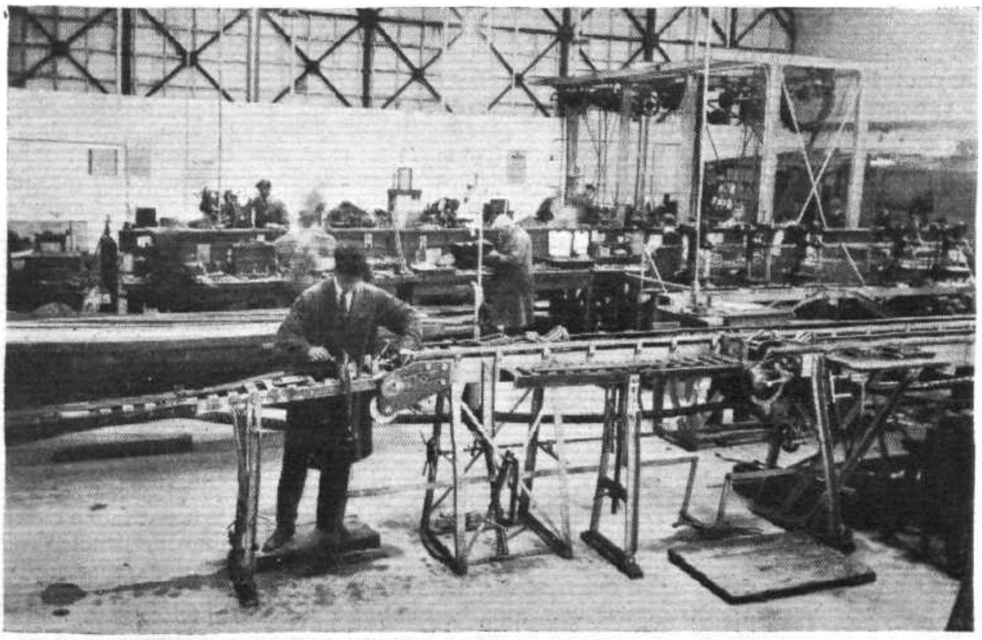
PROTECTION AGAINST CORROSION: Portion of the plant used for anodic treatment of Duralumin.

(FLIGHT *Photo.*)



The Heat Treatment and Sand Blasting Department.

(FLIGHT *Photo.*)



A COMPLETE WORKS ON A SMALL SCALE: A corner of the Experimental Shop. (FLIGHT *Photo.*)

THE BRUSSELS MEETING

ON Sunday, September 21, the Royal Aero Club of Belgium held an International Meeting at the Evere Aerodrome, near Brussels. This was a very large meeting, and was in connection with the Brussels Centenary Celebrations.

It was preceded on September 17, 18, 19 and 20, by a touring competition for light aircraft, much on the same lines as the recent International Touring Competition. Details of this, as far as it had gone, were not available, but it seemed to be taken as a foregone conclusion that Herr Lusser, on the Klemm (Argus) would be the winner, with Herr Fahrbach on a Klemm (Salmson) second, and M. Lemoine on a Potez (Renault) third. These three were the first item on the Saturday, when they left on their speed trial, which was concluded during the afternoon's programme.

The English visitors included a Flight from No. 43 Squadron, R.A.F., who were invited to give a display; Mr. H. H. Leech in a Desoutter (Hermes); Col. Strange in a Spartan (Gipsy II); and Capt. Broad in a Moth (Gipsy I); later on Mr. Rawson arrived, and was able to show the crowd who had by then assembled, just how an Autogiro can be dropped on to the ground.

After the departure of the contestants for the competition, M. Barbot gave a demonstration of how a Fokker C. V-D. (Hispano-Suiza) may readily be turned round and round under its own power by the help of its Messier wheel brakes. He then took off and zoomed about over the crowd, emitting an ear-splitting scream reminiscent of the Fox squadron when they first appeared at Hendon, after landing he again made several tight turns and manœuvred his own way up to the machine park.

The next item was a formation flight by three Westland Wessex machines (Genet Majors). It was somewhat novel to see air liners formating and generally providing amusement for a crowd on the ground, but the ease with which they took off and were handled should certainly be good propaganda for the SABENA and Westland Co's. They crossed the aerodrome in line astern, stepped up about 100 ft. in each case, and then turned and came across again in echelon to the right, still stepped up—a very effective formation for three-engined machines of this size. When landing they appeared to make full use of their wheel brakes. We understand that the SABENA are very pleased with this machine, and it is gratifying to think that England is able to export commercial aircraft on the strength of their performance, for the Wessex will definitely climb with full load on any two engines, which for three-engined machines to be of any use is as it should be; machines of such a type which require their full power to take off and even maintain their height are far too prevalent and make the use of three engines an unjustifiable complication.

The third Bombing Group of the Second Aviation Regiment put five Breguet XIX's (Hispano-Suiza) into the air and gave an exhibition of formation flying. They came over in an excellent V-formation, then in line astern, and landed after several turns.

The next event was the tragedy of the meeting. M. Stachevsky, a young parachutist, was taken up in an R.S.V. (Hermes), and at about 3,000 ft. he left the machine. The parachute for the first part of his drop was in a metal container on the side of the fuselage. This opened safely, albeit somewhat slowly, and when he had come down some 500 ft. he cut the cord of this chute and pulled the rip cord of another chute, which in turn opened slowly again. After about 500 ft. he cut himself adrift, but the third chute failed him, and he fell about 2,000 ft. on to the aerodrome. It says a great deal for the staying powers of the Belgian public that large numbers of them did not leave then and there after witnessing such a ghastly beginning to the meeting, especially as there was no attempt made to get a machine into the air quickly to take their minds off it, in fact there was a wait of not far short of half an hour, during which time an ambulance made its way leisurely to remove the corpse. The whole episode serves to emphasise the futility of stunts such as parachute drops and wing walking at these meetings. Parachutes are appliances which are designed to save life, and ought not to be used to provide thrills for the crowd. Although the majority of chutes in common use are perfectly reliable, there still remains an element of danger which it is unjustifiable to include in public demonstrations, and the amount of harm which such an incident as that at this meeting will do to the cause of aviation is incalculable. Those who know all about these matters will, of course, say that parachutes are nothing to do with aircraft, but that will not hold water when dealing with the feelings of the general public, who if they see a death caused by a parachute failing to open, a man losing his hold when wing walking, or—as happened at Böblingen last Thursday—people trying to get from one aircraft to another in flight, with the result that all the occupants of both aircraft are killed, will always associate such tragedies with aircraft as a whole. We said a certain amount on the subject of wing-walking in FLIGHT last week, and we sincerely trust that promoters of these meetings will not allow themselves to be beguiled into taking unnecessary risks in order to thrill the crowd. Demonstrations of parachutes may, admittedly, be necessary for *bona-fide* purchasers, although for tests, drops with dummies are largely made use of, but for sensations at meetings they can serve no useful purpose in the long run.

Capt. Broad was the next pilot up, and he gave an exhibition of aerobatics and inverted flying in the manner to which we are well accustomed to see him do in this country. Against the following turn his Moth appeared to be under-powered, of course, but power for power his display was just as effective.

M. Michel Detroyat, who followed in a Morane monoplane (Salmson), left one in no doubt as to his ability to handle his machine, and such manœuvres as outside loops did not appear to worry him at all. He flew crazily far too near the crowd for our way of thinking, considering the bumpy weather, but he was certainly a great attraction. As a comic relief he made his final zooms over the control tower while using a large exhaust whistle.

About this time a Farman F-170 (Farman engine), which runs on one of the local feeder lines, came in, a most ungainly machine, but said to be comfortable inside.

One flight of the First Fighter Group of the Second Aviation Regiment, consisting of three Avia BH 21's, then gave an exhibition of formation flying. Their Vee formation was close and well executed and their turns in the same formation were tight. Their loops were, however, somewhat ragged, and it looked as if the bumps worried them rather a lot. Their loops in line astern stepped up about 100 ft., were well carried out, but here, again, the last two men were somewhat thrown about by the slipstream of the preceding machines.

The next event was formation aerobatics by the flight of No. 43 (Fighter) Squadron R.A.F. on Siskins (Jaguar). They carried out their first manoeuvres roped together, in the same manner as they did at Hendon and more recently at Leicester. Their whole display was magnificent and their formations even closer than we have seen before. This was undoubtedly the star turn of the afternoon, and we doubt if it can ever be surpassed for cleanliness of execution.

Following them came three Fokker C.V.-D.'s (Hispano-Suiza) of the Royal Dutch Air Force. In view of the fact that these were two-seaters, their exhibition was exceptionally fine, and they carried out a considerable number of manœuvres which we are more wont to associate with single-seater fighters and moreover carried them out well.

Owing to delays in the programme the events were by this time some three-quarters of an hour behindhand and we were forced to leave before the last two. We understand, however, that these were performed with the same efficiency as the previous events; the first was formation evolutions by five Fokkers (three Titans) of the SABENA, and the second and final item was group evolutions by the Third Group of the First Aviation Regiment, consisting of three Breguet XIX's and six D.H.4's.

Presumably Brussels is not quite so surfeited as we are with air meetings, but even allowing for that the number of spectators was really extraordinary, and there must have been well over 100,000 present who, in spite of the terrific downpours of rain, through which they had to stand, seemed quite cheerful and remained to the bitter end. It was unfortunate that there were only three visiting English aircraft apart from those competing, but they were of diverse types and seemed to provide the spectators with a great deal of interest. Although the weather was none too good we should have thought that many more private owners would have come over for the day. Brussels is not much over an hour's flying from Calais and the journey from this country and back can easily be made in the day.

The machine Mr. H. H. Leech had over was a Desoutter (Hermes) belonging to Phillips and Powis, of Reading, while Col. Strange's Spartan was one of the three-seater type. This is a rather interesting machine and extremely comfortable to fly in. With the Gipsy II engine it has a very good turn of speed indeed, and there is ample room for the two passengers in the front cockpit. This fact makes it radically different

from the ordinary light aircraft manufactured in this country, and in spite of the extra load the performance is even better than some two-seaters. The take-off is all that could be wished for, as is the climb, while the slow sinking speed, combined with a fairly steep gliding angle, allows the machine to be landed in very small fields. Arrangements for getting the passengers in and out are such that this can be done in a minimum of time, and those clubs which indulge in a certain amount of joy-riding should find in the Spartan a machine to fill their needs admirably.

GLIDING

GLIDING IN EDINBURGH.—An endeavour is being made to start a Gliding and Soaring Club in Edinburgh. Thirty potential members have been gained, and in addition, the active sympathy of Sqd.-Ldr. J. A. McKelvie, of the City of Edinburgh Bombing Squadron, about ten of his pilots, about fifteen observers, and some riggers has been enlisted. Those interested should apply to Mr. James Currie, 16, Bernard Street, Leith.

The latest Lowe-Wylde training glider, which has been designed to replace the usual Zögling type. This glider has a form of fuselage which is ply-wood covered. The wings are strutted with spruce struts covered in ply, as is the leading edge of the wing. (FLIGHT *Photo.*)

THE SHEFFIELD GLIDING CLUB has gone ahead steadily since its formation, and under the able leadership of Capt. A. Holden a great deal of instructional flying has been done. During the week-end many successful flights were made from Owler Bar and Mr. J. Brougham, the licensee of the Peacock Inn, has generously provided housing for the glider.

GLIDING INSURANCE.—The firm of Maxtone Graham and Co., Bush House, W.C.2, are specialising in insurance for gliders. Their scheme provides :—

A1. Comprehensive :—Total loss, partial damage, ground risks, transit risks.

A2. Total loss only.

A3. Total loss, ground risks and transit risks.

A4. Ground and transit risks only.

The excesses (£15, £20 and £25 each and every loss, based on the value of the glider) apply only to the partial damage section.

Insurers taking an A1 policy practically get their total loss, ground and transit risks " thrown in."

The definition of a total loss (75 per cent. damaged) is generous.

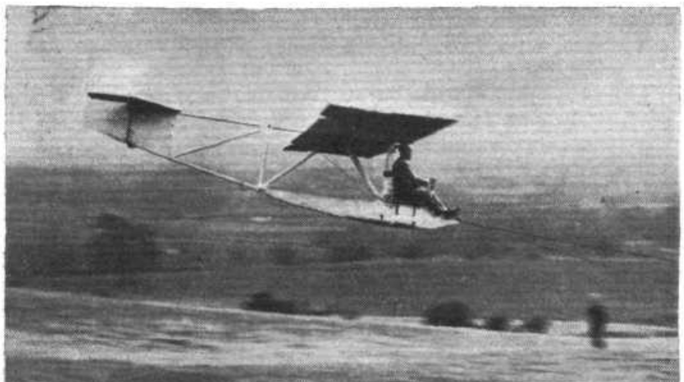
Transit risks.—" Warranted packed " is intended to cover the usual trailer crate, which is generally used, and the words " whilst being towed " have been specially inserted.

B policy. Third party insurance. The excess of £5 each and every claim applies only to damage to crops.

C. Two forms of personal accident benefit are written :—

1. Death or disablement.
2. Death only.

The security is, of course, excellent, being that of Lloyd's underwriters.



Flt.-Lt. Crawford on the left in a Kent Club Zögling, and Mr. Derham on the right in a Channel Club Zögling, at a meeting held by the former club last week-end. (FLIGHT *Photos.*)

MODELS

T.M.A.C. Forthcoming Display

To put a good finish to the 1930 season a special display will be held at Wimbledon Common (near the Windmill) on the afternoon of Saturday, October 4. After the Model Engineering Exhibition Display, and the big extension scheme now launched, great things are expected of the T.M.A.C. Members are urged to have their models in trim, and give this meeting their fullest support.

AIR TRANSPORT

THE LONDON–CAPE TOWN AIR SERVICE

First Section to Open Next January

On September 22, Lieut.-Col. J. Barrett-Lennard, a director of Imperial Airways, arrived at Southampton, in the Union Castle liner *Armadale Castle*, from South Africa, where he has concluded the final arrangements for the Croydon-Cape Town air mail service. He stated that the first section of the route, from Croydon to Kisumu, Lake Victoria, would be opened next January, while it is hoped to open the second section to the Cape the following April, when the full service will occupy 11 days—later this time will be reduced to nine days.

Arrangements for the full service have already been made, including the provision of rest and refreshment-house facilities along the route where required. The daily schedules, intermediate halts, and types of aircraft have all been decided upon. The route is almost identical to the one suggested at the outset, viz., following the course of the Nile from Cairo, then passing through Uganda, Tanganyika, and Rhodesia, the total distance to the Cape being about 5,750 miles.

The stages and calling places over the whole African route will be :—Cairo, Assiut, Luxor, Aswan, Wady Halfa, Karima, Khartoum, Kosti, Malakal, Shambe, Juba, Butiaba, Port Bell, Kisumu, Nairobi, Moshi, Dodoma, Mbeya, Mpika, Broken Hill, Salisbury, Buluwayo, Pietersburg, Johannesburg, Kimberley, Victoria West, Cape Town.

The service will be once a week, in each direction at the start, and the fare for the entire journey to or from Croydon (roughly 6,000 miles) will be £125, including hotels, etc. Connection with the London-India service will be made at Cairo. The longest stage will not exceed eight hours' duration.

It is hoped, eventually, to introduce night flying over certain sections of the route, and thus speed up the time for the complete journey.

As regards the machines to be employed, from Croydon to Salonica, the new Handley-Page 40-seaters will be used, while the Mediteranean crossing, to Alexandria, will be made in four-engined flying boats. Armstrong-Whitworth "Argosies" will take over the section between Alexandria and Khartoum, then Short "Calcutta" flying-boats, following the Nile and Lakes, will be used. The remaining portion of the route will be served by D.H. "Hercules" machines. All machines, it should be noted, are multi-engined.

A full scheme for the development of the meteorological service along the route has been laid down, and much has already been done in this direction, although at first it is possible that complete arrangements may be unfinished.

It is reported that a temporary agreement, subject to future Egyptian legislation, has been reached by the Egyptian Government and the Imperial Airways with regard to the Cape to Cairo air service. It was agreed that British air law would be observed in such matters as licensing pilots, and the testing and inspection of machines for this service.

R101 HAS TWO REVERSIBLE ENGINES

It is very gratifying to learn that the attempts to reverse the Beardmore compression-ignition engine have proved so successful that it has been decided to instal two reversible engines in R 101. Both the forward wing engines will be able to reverse. The new engine is already in place in the port forward power egg, and the similar starboard engine is to be installed during this week. Driving astern is a very rare manœuvre, and practically is only used during mooring operations in case the ship should show a tendency to overshoot the mast. When R 100 moored on her return from Canada there was no necessity to reverse any of the Condors, two of which are fitted with reversing gear. Still, when a drive astern is needed, it is needed very badly, for damage to the hull through overshooting the tower, such as once befell R 36, must not be risked. That was the reason why R 101 has hitherto had to reserve one engine, representing 20 per cent. of her total power, for driving astern. For the future she will be able to use all five engines for driving ahead, and any experimental feature in the device for reversing the camshaft will be obviated by having two reversible engines.

The new bay and new gas bag have been inserted in R 101, aft of the passenger coach, and various impedimenta which were found unnecessary for operating the airship, such as the servo motor for working the control surfaces, have been removed. The unnecessary amount of clearance between the gas bags and the frame of the hull has been abolished by letting out the wire net which surrounds each bag. The lift and power of R 101 have now been very considerably increased. A new cover has been made and put in place, and has been doped after fitting instead of before fitting. For one of the main engines a Beardmore heavy-oil starting engine has been fitted. If the weather is favourable, R 101 may be brought out of her shed about the end of this week.

The next step will be a trial flight over the British Isles, and then, if all goes well, a date will be fixed for the departure for Ismailia and Karachi. Lord Thomson, Air Minister, proposes to make the journey in the airship, and if he is able to do so he will have much of interest to tell the Imperial Conference. Barring the flight of one Zeppelin from Bulgaria to Central Africa during the war, and the recent flight of the civil "Graf Zeppelin" to Brazil, this flight of R 101 will be the first flight of a rigid airship into tropical climes. It will be an immensely interesting experiment, and should teach lessons of the utmost value.

Croydon-Liverpool Service Discontinued

The experimental air service between Croydon, Birmingham, Manchester and Liverpool was discontinued, for the winter, on September 20. On the whole the service, which started last June, with the financial assistance of the three cities served, may be considered to have been successful, for only one journey was not completed. It is hoped that the service will be resumed next summer, and it is possible that the introduction of night flying will enable the service to be run for a longer period.

Sir Samuel Hoare and Air Communications

On September 18, Sir Samuel Hoare delivered an address on "Air Communications," at the Bonar Law College, Ashridge, in which he made a number of interesting observations, especially as regards the attitude of the G.P.O. and Air Mails. Unfortunately, pressure on our space this week prevents our dealing with this address, but we hope to do so next week.

A Berlin-Nankin Air Service

Proposals have been made to establish a bi-weekly aeroplane service between Berlin and Nankin, it is hoped next April, with 15-passenger machines and following the Trans-Siberian Railway. Negotiations are proceeding with the Soviet Government in this connection.

THE ROYAL AIR FORCE

London Gazette, September 16, 1930

General Duties Branch.

Lt. J. E. Vallance, R.N., is reattached to the R.A.F. as a Flying Officer, with effect from Sept. 1 and with seniority of Jan. 12.

Pilot Officer on probation S. N. Wiltshire is confirmed in rank (Aug. 22).

The following Pilot Officers are promoted to the rank of Flying Officer (Aug. 22) :—G. N. Roberts, H. L. Smith, G. E. Mustard, R. E. H. Beaton, R. A. Davies, G. P. Longfield, G. P. Marvin.

Flight Lt. F. W. W. Wilson takes rank and precedence as if his appointment as Flight Lt. bore date Jan. 1, 1928, immediately following Flight Lt. M. B. Mackay on the graduation list. Reduction takes effect from July 2.

The following Flying Officers are transferred to the Reserve, Class A (Sept. 12) :—E. G. L. Russell, A. W. Shaw, E. A. Swiss.

Flight Lt. A. W. Rowbotham resigns his short service commission (Sept. 10).

Flying Officer E. M. Thompson relinquishes his short service commission on account of ill-health (Sept. 12).

The following Lts. R.N., Flying Officers, R.A.F., cease to be attached to the R.A.F. on return to naval duty :—C. A. R. Gibb (Sept. 1) ; G. Willoughby (Sept. 2).

Flying Officer R. Mundy-Cox relinquishes his short service commission on completion of service (Sept. 16).

The short service commission of Pilot Officer on probation S. M. Worrall is terminated on cessation of duty (Sept. 15).

Memorandum.

The permission granted to Lt. J. Bradbury to retain his rank is withdrawn on his enlistment in the Supplementary Reserve (Aug. 27).

RESERVE OF AIR FORCE OFFICERS

General Duties Branch

The follg. Pilot Officers on probation are confirmed in rank :—C. M. Dransfield (July 31) ; P. E. Hudson (Sept. 2) ; A. Dewsbury, L. E. Hunt, F. Ingham (Sept. 4).

The follg. are transferred from Class A to Class C :—Flight Lt. A. Haines (Jan. 3) ; Flying Officer K. K. Brown (Sept. 17) ; Flying Officer C. N. A. B. Mumby (Jan. 19).

The follg. Flying Officers relinquish their commissions on completion of service :—D. G. Pinnell (Aug. 21) ; B. H. Shaw (Sept. 2).

Flying Officer K. W. Brewster, M.C., relinquishes his commission on account of ill-health and is permitted to retain his rank (Sept. 17).

Flying Officer A. A. N. D. Pentland, M.C., D.F.C., relinquishes his commission on completion of service and is granted permission to retain the rank of Flight Lieut. (July 21).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified :—

General Duties Branch

Wing Commander : D. Harries A.F.C., to H.Q., Coastal Area, pending posting to the Air Ministry ; 8.9.30.

Squadron-Leaders : D. W. Clappen, to H.Q., Iraq Command ; 22.8.30. C. H. Keith, to Special Duty List, whilst employed with the Superintendent of Design, Royal Arsenal, Woolwich ; 15.9.30. A. FitzR. Somerset-Leeke. O.B.E., to Special Duty List ; 23.9.30. R. C. Hardstaff, to No. 70 Sqdn., Iraq ; 22.8.30.

Flight-Lieutenants : S. N. Webster, A.F.C., to No. 70 Sqdn., Iraq ; 18.8.30. E. T. Carpenter, A.F.C., to No. 43 Sqdn., Tangmere ; 9.9.30. G. H. Loughnan, to No. 16 Sqdn., Old Sarum ; 5.8.30. J. MacG. Fairweather, D.F.C., to R.A.F. Depot, Uxbridge ; 1.9.30. H. W. Pearson-Rogers, to No. 19 Sqdn., Duxford ; 12.9.30. A. C. Cuming, to H.Q., R.A.F., Transjordan and Palestine ; 5.9.30. J. Potter, to R.A.F. Depot, Aboukir ; 13.9.30. F. H. E. Reeve, to H.Q., R.A.F., Transjordan and Palestine ; 13.9.30. E. H. Rundle, to R.A.F. Depot, Aboukir ; 13.9.30. J. Noonan, D.S.M., to No. 2 Armoured Car Company, Palestine ; 13.9.30. F. E. Watts, to No. 4 Flying Training Schl., Abu Sueir ; 13.9.30. D. H. de Burgh, A.F.C., to Schl. of Photography, South Farnborough ; 4.8.30. S. A. Turner, M.B.E., to R.A.F. Depot, Uxbridge ; 9.9.30.

Flying Officers.—A. F. Merritt, to R.A.F. Depot, Uxbridge ; 15.8.30. K. E. Parker, to H.M.S. *Eagle*, Mediterranean ; 17.7.30. J. W. P. Sloan, to No. 207 Sqdn., Bircham Newton ; 15.9.30. P. A. Moritz, to R.A.F. Depot, Uxbridge ; 1.9.30. F. Townsend, to No. 2 Sqdn., Manston ; 8.9.30. E. L. J. Rowe, to R.A.F. Depot, Uxbridge ; 11.9.30. D. L. Iremonger, to Aircraft Park, India ; 16.9.30. C. K. Turner Hughes, to No. 24 Sqdn., Northolt ; 11.9.30. J. N. Jaques, to Central Flying Schl., Wittering, on appointment to a short service commn. ; 9.9.30. C. W. F. Carter, to No. 208 Sqdn., Heliopolis ; 13.9.30. F. R. Jones, to No. 47 Sqdn., Khartoum ; 13.9.30. F. P. Hewitt, to No. 45 Sqdn., Helwan ; 13.9.30. S. P. Richards to No. 6 Sqdn., Ismailia ; 13.9.30. C. M. Champion de Crespigny, to No. 208 Sqdn., Heliopolis ; 13.9.30.

Pilot Officers : H. D. Primrose, to No. 3 Sqdn., Upavon ; 13.8.30. T. W. Hoyle, to Aircraft Park, India ; 16.9.30. W. S. Hebden, to No. 20 Sqdn., India ; 16.9.30. P. F. Canning, to No. 27 Sqdn., India ; 16.9.30. F. F. Wicks, to No. 5 Sqdn., India ; 16.9.30. W. I. H. Burke, to No. 202 Sqdn., Malta ; 12.9.30.

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CROYDON WEEKLY NOTES

SUMMER having officially come to an end the air transport companies are cutting down their services to a winter schedule. The inland service to Liverpool stopped on September 20 after an experimental period of three months. Its continuance next year depends on discussions between Imperial Airways and the local authorities of Birmingham, Manchester and Liverpool, who will express their opinions as to its value to their cities.

The Le Touquet route has been surprisingly popular this year, and was taken off only last week-end, a date much later than was anticipated. Gold shipments continue to be a paying freight for Imperial Airways, and a special machine has been allocated for the work.

An announcement interesting to passengers is that the fare on the 5 p.m. Imperial service to Paris has been reduced from £5 15*s*. to £4 4*s*., which is the same as for the 8 a.m. service.

Last Tuesday we were visited by Lord and Lady Baden-Powell, who, with their children, were shown round the air port by Maj. Richards, the chief aerodrome officer. They were most observant, and keenly interested in everything they saw. Their visit reminded one of the earliest days of flying, when Maj. Baden Powell, the Chief Scout's brother, was not only devoted to ballooning, but built his "Quadruplane" at Barking.

Though it appears from the daily press that a number of flights to Australia are pending, the only departure this week has been Capt. F. R. Matthews, the well-known instructor of the London Aeroplane Club. His mount is a Puss Moth, and he is making as good progress as the bad weather allows.

Quite a number of Croydon people were attracted to the Second International Meeting of the Antwerp Flying Club. They give wonderful accounts of the hospitality they received, and of the care that was taken of them. British pilots and their machines seem to have taken more than their share of prizes. Miss Winifred Brown and Messrs. "Tommy" Rose, Jackaman, and Styran had several apiece.

An unfortunate but still amusing incident is told of one of them flying a modern type of light cabin machine. The passenger wishing for fresh air reached up and, as he thought, opened the ventilators each side. A moment or so later the engine faded, and they had to make a forced landing. It was then found that the miserable passenger had turned off both petrol cocks instead of opening the ventilators. Designers, please note !

We understand from Mr. "Fred." Rose that Walcot Air Lines have now removed their base from Croydon to Heston. May they find plenty of activity in their new surroundings.

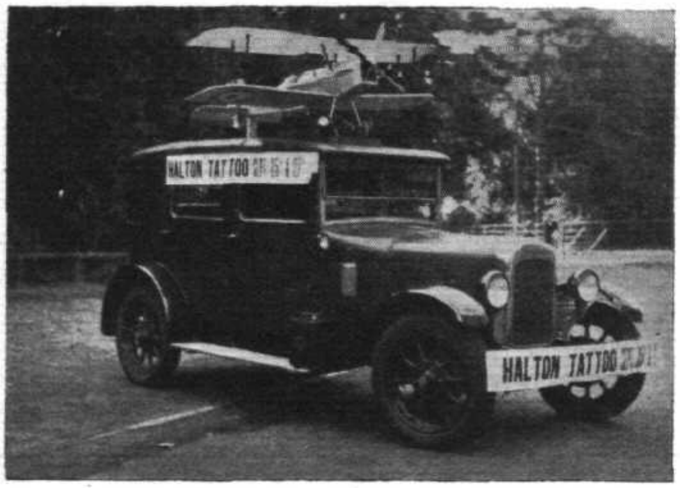
The A.D.C. Aircraft, Ltd. have now fitted an Inverted Hermes into their Desoutter machine. It is said to run very sweetly indeed, and has increased the speed somewhat. Last week it took Messrs. Thorn & Holman to Paris and back in very comfortable style, the outward trip being done in a bare two hours. A.D.C. have been fitting out Flight-Lt. Atcherley's Hermes-Avian monoplane for inverted flying. The man who said that he had Atchually seen it flying upside down for five minutes ought to have been unstrapped in the cockpit.

Much resentment has been expressed amongst Croydon pilots and officials against the decision of the Belgian authorities that one cause of the night mail accident was the bad aerodrome lighting. Those who are experienced sufficiently to know, declare the Croydon lighting to be as good as the best anywhere and much better than most. Undoubtedly, visibility was bad on that particular night and there was mist and low cloud in the district. Which is a different thing altogether.

We were very interested in Sir Samuel Hoare's address to the students of Bonar Law College, on September 18. He stated that British Air lines—meaning Imperial Airways, presumably—could show an unbeaten record for safety and punctuality. Following which he said that there was no reason technically why the Indian mail should take longer than 30 or 40 hours. In saying this, he was perfectly correct. Yet each successive generation of our "air mail" machines seems to be slower than the last. Nor does there seem to be any particular connection between slowness and safety, within practical limits. If size and bulk mean anything, then we certainly lead.

We were glad to see "Tommy" Thompson back after his adventures amongst the mountains and jungles of New Guinea. He tells us that air transport of gold from mines to base has thoroughly established itself out there and become a sound commercial business.

Last week, 1,034 passengers and 60 tons of freight were handled through the air port. M. L.



A model of an S.E.5 which was used to advertise the R.A.F. Halton Tattoo held at Halton last Thursday and which will be repeated on Saturday.

Laulhe's Light 'Plane Record

Some further particulars are to hand regarding the light 'plane distance record (closed circuit) established by the French pilot Laulhe. On August 28, Laulhe in his Albert monoplane, with a 40 h.p. Salmson motor, took off from Le Bourget to attempt to break the distance record for light aeroplanes of the third class, *i.e.*, monoplanes weighing empty from 200 to 350 kg. This record was held, since June 7, 1928, by the Czecho-Slovakian Commandant Vicherek with an Avia B.H.11 monoplane fitted with a 60 h.p. Walter engine, the distance traversed being 2,500 km. Laulhe's flight, however, was interrupted shortly after the departure by the intense heat, which overpowered the pilot. Laulhe started another attempt on September 4, at 6.43 a.m., and set out on a route of 70 km. marked out by the lighthouse of the port of Le Bourget and Nanteuil-le-Haudouin. Throughout the day, Laulhe's flight was very regular, and at 7.15 p.m., *i.e.*, after a flight of 12 hr. 32 min., the Albert monoplane had circled round the course 20 times, a distance of 1,400 km., at an average speed of 112 km. per hour. During the night the weather was very bad and a storm nearly put an end to the success of the flight ; Laulhe did not land, however, but flew off the course for about an hour and a half, seeking better conditions, and, by so doing, he lost a good number of kilometres. On September 5, at 6.17 a.m., Laulhe completed his thirty-sixth journey round the course ; at 7.28 a.m. he broke the record with 37 circuits ; at 8.6 a.m. he completed the thirty-eighth journey, and finally, at 8.44 a.m., the Albert landed at Le Bourget after having travelled 2,714 km. 400 m. in 26 hr. 1 min. The machine and engine behaved perfectly during the whole of the trial, and Laulhe hopes to attack the record for distance in a straight line, which is held by Zimmerly in a Barling NB2.

Air Mails to India and Dutch East Indies

The winter time-table of the through air service from this country to India came into force on September 20. It is officially stated that the latest time of posting at the special air mail posting box at the General Post Office, London, will be 6 a.m. on Saturdays, as at present, and proportionately earlier at the other Air Mail posting boxes in London. The latest time of posting in the Provinces can be ascertained locally.

The mails will be due to arrive as follows :—At Alexandria on the following Tuesday evening ; at Gaza on Wednesday morning ; at Baghdad on Wednesday evening ; at Basra on Thursday morning ; at Karachi on Saturday afternoon ; and at Delhi on Sunday afternoon. In the homeward direction, the air mail will be due to leave Delhi on Tuesday and Karachi on Wednesday, and to arrive at Croydon on Wednesday afternoon.

The air fees—in addition to ordinary postage—are as follows :—To Egypt and Palestine, 2*d.* per ½ oz. ; to Iraq, 3½*d.* per ½ oz. ; to Persia, 5*d.* per ½ oz. ; to Karachi (with onward transmission by ordinary route), 5*d.* per ½ oz. ; and to Delhi, 7*d.* per ½ oz.

The Postmaster-General also announces that the air service between Amsterdam and the Dutch East Indies, which came into operation on September 25, will be available for all classes of correspondence, except parcels, posted in this country for Siam, the Straits Settlements, Malay States, and for the Dutch East Indies. Packets may be registered but not insured. The service will start from Amsterdam on Thursdays, the first three flights leaving on September 25, October 2 and October 16 ; thereafter the service will be fortnightly.

The times of transit to various destinations are expected to be as follows :—To Bangkok, 11 days, as compared with 23–26 days by ordinary route ; to Penang, 14–15 days, as compared with 21–22 days by ordinary route ; to Singapore, 15–16 days, as compared with 22–23 days by ordinary route ; to Batavia, 13 days, as compared with 26–27 days by ordinary route.

The air fees, to be prepaid by ordinary postage stamps, in addition to the ordinary postage fee and other charges, if any, are as follows :—To Siam, Straits Settlements and Malay States, 1*s.* per ½ oz. ; to Dutch East Indies, 1*s.* 3*d.* per ½ oz.

The latest time of posting at the General Post Office, London, will be 8.30 a.m. on Wednesdays.

PUBLICATIONS RECEIVED

Jahrbuch der Wissenschaftlichen Gesellschaft für Luftfahrt e.V. (W.G.L.), 1929. R. Oldenbourg, Munich. Price M.26.

Department of Overseas Trade Reports. Economic Conditions in Persia. March 1930. By E. R. Lingeman. Price 1*s.* 6*d.* net. *Economic Conditions in Yugoslavia.* By H. N. Sturrock. Price 1s. net. H.M. Stationery Office, Kingsway, London, W.C.2.

Principles and Operation of Pioneer Instruments. Pioneer Instrument Co., 754, Lexington Avenue, Brooklyn, New York.

Aerial A.B.C. June-August, 1930. The Aerial A.B.C., Ltd., 4, Duke Street, Adelphi, W.C.2. Price 1*s.*

Jupiter Series IV Aero Engine. Air Publication 1162. H.M. Stationery Office, Kingsway, London, W.C.2. Price 2*s.* 6*d.* net.

A Study of Visibility and Fog at Malta. By J. Wadsworth, M.A. Meteorological Office, Geophysical Memoirs No. 51. M.O.331a. H.M. Stationery Office, Kingsway, London, W.C.2. Price 1*s.* 6*d.* net.

NEW COMPANIES REGISTERED

READING AERO CLUB, LTD., Reading Aerodrome, Woodley, Berks.—Capital £100, in £1 shares. Directors : C. O. Powis, E. J. Phillips, D. E. Swan, E. E. Stammers, Coventry House, 3, South Place, E.C.2. Solicitors : W. R. J. Hickman, Randall & Stammers, Coventry House, 3, South Place, E.C.

P. B. DEVIATOR, LTD., 168, Regent Street, W.1.—Capital £10,000, in £1 shares. Aeronautical experts and consultants, manufacturers and repairers of and dealers in aeroplanes, seaplanes, airships, balloons, compasses, etc. Subscribers : J. P. Brown, Hillcroft, Park Hill Rise, Croydon, aeronautical engineer ; W. E. Dommett, 14, Cranes Park, Surbiton, consulting engineer.

AERONAUTICAL PATENT SPECIFICATIONS

(*Abbreviations* : Cyl. = cylinder ; i.c. = internal combustion ; m. = motors. The numbers in brackets are those under which the Specification will be printed and abridged, etc.)

APPLIED FOR IN 1929

Published September 25, 1930

17,245. Boulton and Paul, Ltd., J. D. North and V. J. Johnston. Metal spars. (334,287.)

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